METAL INDUSTRY

21 MARCH 1958

Faith in the Future

PLANS to spend £10,000,000 over the next four years, nearly £8,000,000 of this being for new plant and buildings, have been announced by the Northern Aluminium Company Limited. The major part of this programme will be the expansion of the rolling mill at Rogerstone, Monmouthshire, raising its annual capacity to 75,000 tons in such a way that a further increase will be possible—at a relatively low cost per ton—to an ultimate capacity of 175,000 tons. The remainder of the investment will be in further modernization of the Banbury and Birmingham works.

The basic reason for the scheme is to increase the range and lower the cost of the company's products, of which a substantial part is exported directly, and an even higher proportion in the form of finished goods made by domestic consumers. In the face of increasing competition from abroad, and the trend for aluminium fabricators to build their own plants in countries that have customarily imported products from the United Kingdom, more efficient production methods have become essential. It is believed that these can best be attained by the large modern rolling mill with a high rate of through-put, coupled with the necessary flexibility to handle the diversity of light-alloy products demanded by industry today. Wider and longer plate in aluminium and its medium-strength alloys will become available to meet the needs of the shipbuilding, chemical, atomic energy and similar industries while larger sizes of medium-strength alloy sheet will be offered for the more economic construction of road and rail vehicles and for general engineering. A product with much significance for the aircraft designer will be massive, heat-treated, high-strength alloy plate. In addition, the cost and quality of the aluminium and "common" alloy sheet for which the mill is already well equipped will be made more attractive to the building, packaging and other industries that are its main outlets; the increased length of coils will be of value, for instance, to foil rollers.

Principal additions to the plant for this development will include a 12 ft. wide hot mill for "breaking-down" ingots and rolling large plate; the addition of a third stand to the present two-stand hot-finishing mill, with provision for a fourth; and the introduction of hot coiling under tension direct from this mill. Preheating, annealing and re-melting furnaces will be among the ancillary equipment installed to serve the new "hot line," and cold-rolling facilities will also be augmented. Complementary to this are a 4,000-ton stretcher for stress-relieving and flattening plate, a plate heat-treatment furnace, a high-speed plate saw for accurate finishing, and apparatus for testing ultrasonically the internal soundness of thick plate; details of these are given in the article on page 231 of this issue.

The current programme illustrates the company's faith in the future of the British aluminium fabricating industry, and, indeed, in the future of Britain itself. It is opportune that the main part of the expansion is to be in an area where the closing of outdated steel hand mills is causing some loss of employment.

Out of the MELTING POT

General Scope

ANY interest in slip casting should not be taken to reflect in any way upon the assured future of conventional die pressings by which powdered metal parts can be so conveniently and rapidly produced. The interest in slip casting arises from the fact that it can help with powders that are difficult to press satisfactorily, or where the shape or size of the parts to be produced is such as to preclude the use of dies. Having brought in size, consideration of the possibilities of slip casting should be extended to include the production of semi-manufactured products (sheet, strip, etc.) from metal powders. The use of paper-making technique, which fundamentally is a form of slip casting, has, for example, already been suggested in this connection in the related field of fibre metallurgy. Going still further, one might envisage a slip casting process in which the necessary liquid phase would take the form of a molten metal, assuming, that is, powder metallurgy can overcome its abhorrence of molten metals that dates back to the time when it set out to show how superior its techniques and products were to those of common or garden casting. Stretching just a little further, these considerations could be made to include what may be termed paste casting or forming. The only existing example of the latter (dental fillings excepted) is a process in which a paste-like mixture of metal powders and of a binding phase consisting of an age-hardening solution of copper or copper alloy in mercury is formed to the required shape and then sintered, thereby also removing the mercury. Associated with this interest in slip casting would be the need for an examination of the process of sintering of uncompressed metal powders, an examination or re-examination of which would benefit both the theory and practice of this phenomenon.

Not Blameless

SCAPEGOATS are such convenient and, at the same time, such readily overlooked objects, that it usually takes some thorough, and possibly even somewhat painful, searching, including heart-searching, to detect them. Take, for example, "protests" by scientists directed at the bulk of the literature, the occasional inaccessibility, and, more recently, the language difficulty—specifically the Russian language difficulty. Probably the first scapegoat to be encountered here is the fact that it is the scientists themselves who are responsible for the bulk of the literature. Publishing bodies, groaning under the burden of inflated costs of publication, would be only too amenable to consider other ways and means of presenting research results, if only their originators could desist from turning them into literature. Another awkward fact, usually passed over in silence, is that the literature which is the object of all these protests, records only what has already been done, in some cases quite some time ago. Protests about the wastefulness of duplicating research in the absence of an adequate coverage of the literature, carry with them the implication that the research envisaged and allegedly hampered by the non-availability, inaccessibility, ignorance, or what-not of the literature, is largely directed by no more inspired process than that of elimination. That being so, one cannot overlook the probability that were, by some *tour de force* of librarianship, indexing, classification, or electronic information retrieval, and translation where necessary, a complete and up-to-date survey of the literature to be made available, the difficulties of such research work would not have been done away with. It would then be faced, assuming its pedestrian direction by elimination were to recognize it, with the probability that those who had published the literature that had just been so admirably surveyed, had since forged ahead, and may even have "got there," before the research workers, with their insistence on a complete survey of the literature, had even made a start. Would it not be better without scapegoats?

Inhibited

GRAVE doubts have recently been expressed regarding the validity of the age-old saying that two heads are better than one. The doubts arose in connection with that much publicized "thinking" procedure based on the above statement multiplied by a suitable factor, namely the procedure known as brainstorming. By collecting together a number of people, and relegating critical evaluation to a separate later occasion, the brainstorming procedure has been claimed to favour the emergence of ideas on a set problem in larger numbers than would have been forthcoming from the participants thinking about the problem on their own. Evidence to the contrary has now been obtained by Professor D. W. Taylor, of Yale University, from an experiment involving 96 students working on three problems in brainstorming groups and individually. He found that the groups did not do so well as the individuals. One reason for this, he suggests, is that in spite of the absence of criticism during a brainstorming session, those taking part do not feel entirely free of possible criticism, and this feeling has a restraining effect on the ideas they put forward. With a a little practice, an individual on his own can manage to put aside his critical faculties and then proceed to think up various likely and unlikely solutions in a much greater freedom and with much greater confidence than if he had to put them forward in a group meeting. Another reason for the lower effectiveness of group thinking is the unifying effect of the group on the direction in which the thinking of the participants tends to run. People thinking in a group seem to follow the same train of thought much more so than the same number of people working individually. The use of the above evidence and considerations to discredit entirely brainstorming and other forms of co-operative thinking would be wrong. While the epoch-making ideas will probably always spring from great individual minds, for less exalted purposes a combination of group and individual thinking is likely to prove the most productive. Group thinking and group discussion should be retained for the purpose of setting the scene and providing the initial stimulus. Subsequent individual thinking in the absence of expressed or unexpressed but imagined group criticism should then be given a chance to yield bright ideas, including the one that makes you say to yourself: "Now why didn't I think of that at the meeting?"

Skimmer

Finishing Supplement

Vapour Plating of Nickel

By L. W. OWEN

DECOMPOSITION of metallic carbonyls to give metallic deposits has long been recognized as a principle from which a successful plating process might be developed. Despite numerous patents filed on the subject there are, with few exceptions,[1,2] no detailed accounts in the literature of attempts made to make the process work. Deposition of nickel from the carbonyl vapour appears to have received less attention than molybdenum or tungsten, no doubt on account of the fact that nickel has for many years been successfully deposited by other methods, most notably by electrodeposition. However, no process can be applied universally and for certain applications alternative methods to electrodeposition are required. Information[3] from the U.S.A. suggests that the carbonyl process can be operated on a commercial basis.

Preliminary trials showed that it was not difficult to obtain a nickel coating by decomposition of nickel carbonyl vapour, but that the main difficulties were:—

(1) Transport of vapour to the plating vessel, including flow measurement;

(2) removal of undecomposed vapour;

(3) control of temperature of specimen;

(4) design of equipment to facilitate operation of the process.

It should be mentioned here that the process can be operated over a wide range of pressures, from atmospheric pressure and above to the lowest pressures at which an appreciable rate of plating can be obtained. Plating at low pressures has among its advantages precision of control of vapour flow, plating rate and quality of deposit, but plating at atmospheric pressure has the advantage of not requiring vacuum equipment, the attainment of faster plating rates and less restriction on the size of component that can be treated. Plating at reduced pressure, as opposed to low pressure, appears to have no advantages. The equipment and methods described in this article relate to the low pressure method of plating.[4]

The equipment assembled as a working unit is shown in Fig. 1, while Fig. 2 shows schematically the design of the equipment, excluding electrical circuitry. For the purpose of description it can be divided up into four parts:—

(1) The plating vessel.
(2) The high-vacuum system.
(3) The vapour system.
(4) The diluent gas system.

Nickel plating is performed in the plating vessel and nickel carbonyl vapour is conducted to and from it through the vapour system. The plating vessel can be brought into communication with the high vacuum system, with the vapour system in isolation, by opening appropriate connections.

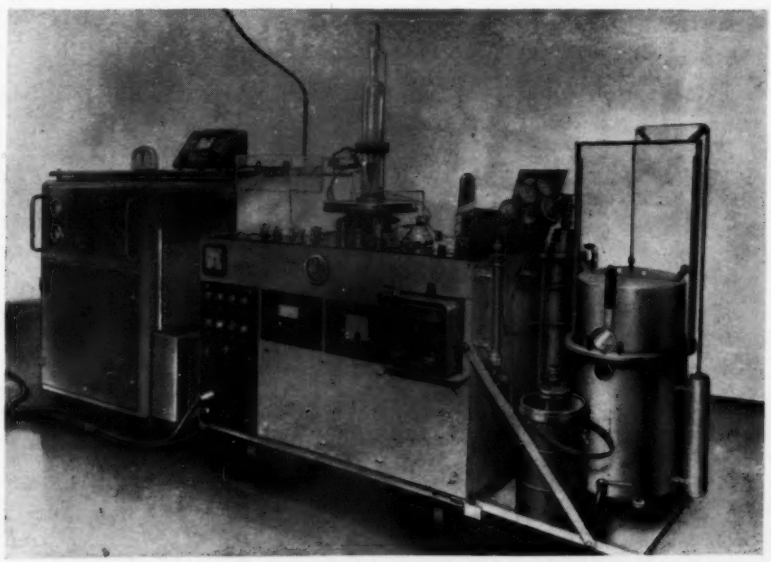
As is shown in Fig. 2, the plating vessel consists of a fixed metal chamber (44) and a demountable glass bell jar (36) bearing a metal flange (41) which mates with the fixed chamber flange (43). The object to be plated (38) is supported on a metal-ceramic stand and heated by means of a work coil (37) energized by H.F. current and in close proximity to the object. The temperature of the object is measured by a thermocouple incorporated in the stand and electrically connected to the indicator (63) via ceramic electrodes (45) sealed in the wall of the metal chamber (44). Isolation of the plating vessel from the vapour system is effected by means of the valves (22, 23, 24 and 25), whilst coupling with the high-vacuum system is controlled by the baffle valve (48) operated by the hand wheel (49).

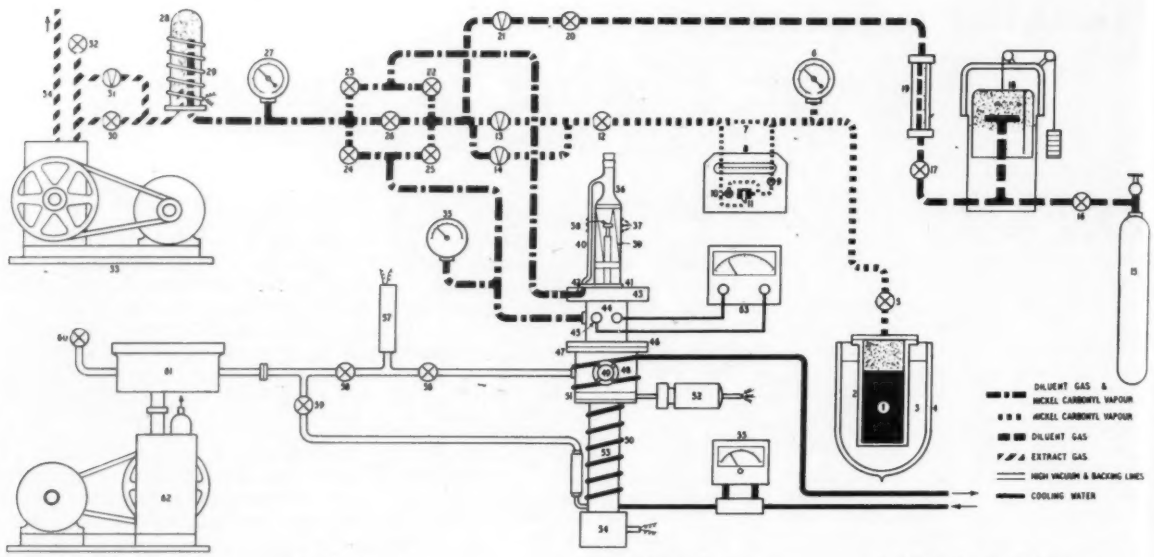
The high-vacuum system employs conventional means to produce vacuum, i.e. a water-cooled oil diffusion pump (53) backed by a rotary oil pump (62). The position of valves (56), (58) and (59) enables "roughing-out" of the chamber, backing of the diffusion pump, and measurement of backing or chamber pressures by the Pirani gauge (57) to be carried out at will. Accurate measurement of low pressures is obtained from the Phillips gauge (52).

The nickel carbonyl vapour source is the liquid carbonyl (1) held in the container (2). With the valve (5) open, vapour can flow through the system to the plating vessel via the pressure gauge (6), the flow meter (7) and the various valves. Residual vapours and the products of decomposition, mainly carbon monoxide, are extracted by the rotary oil pump (33) via the pressure gauges (35) and (27), the vapour trap (28) and control valves. Diluent gas enters the system between the flow control needle valves (13) and (14) and the flow reversing assembly of valves (22) to (25).

The nickel carbonyl in the container (2) is held in melting ice (3) in a Dewar flask (4). Thus, a constant pressure source of vapour is obtained at a pressure where condensation in the system is avoided. The rate of flow of vapour through the capillary (7) is accurately metered by a bellows differential pressure manometer (9) which incorporates means for isolation (for permitting unrestricted large flows) or zero setting (valves 9 and 10). Vapour enters or leaves the plating vessel at two points, the body of the fixed chamber and the flange (43). Channels are cut in the flange at (42) so that a connection with the bell jar is obtained via the delivery tube (40). By appropriate adjustment of the flow reversing valves (22, 23, 24 and 25) the vapour can either be conducted into the plating vessel at the top of the bell jar and extracted at a point below it, or

Fig. 1—General view of the plating unit





1 Liquid nickel carbonyl
2 Container
3 Melting ice
4 Dewar flask
5 Metal vacuum valve
6 Bourdon vacuum gauge 0-400 mm. Hg.
7—Flowmeter capillary
8—Flowmeter indicator bellows manometer
9—Flowmeter isolation valve
10—Bellows by-pass control valve
11—Capsule and bellows
12—Isolation valve
13—Needle valve (fine)
14—Needle valve (coarse)
15—Cylinder of compressed gas
16—Isolation valve
17—Isolation valve
18—Gas holder
19—Flowmeter rotameter
20—Isolation valve
21—Needle valve
22-25—Valves, flow reversing
26—Control valve plating vessel by-pass
27—Bourdon type vacuum gauge 0-100 mm. Hg.
28—Vapour trap
29—Heating tape
30—Isolation valve
31—Needle valve
32—Air admittance valve
33—Rotary oil vacuum pump (vapour line)
34—Extract
35—Bourdon type vacuum gauge 0-10 mm. Hg.
36—Demountable bell jar
37—High frequency heating work coil
38—Object to be plated
39—Electrostatic screening wire on bell jar
40—External delivery tube of bell jar
41—Bell jar flange
42—Channel connecting pipe to bell jar external delivery tube
43—Flange
44—Metal chamber between bell jar and baffle valve
45—Ceramic insulated electrode
46—Flange
47—Flange
48—Baffle valve for diffusion pump
49—Baffle valve control
50—Copper coils carrying cooling water
51—Intermediate flange between the baffle valve and diffusion pump
52—Phillips vacuum gauge head
53—Oil diffusion pump
54—Electric heater for diffusion pump
55—Water flow indicator
56—Isolation valve
57—Pirani vacuum gauge head
58-60—Isolation valves
61—P_2O_5 moisture trap
62—Rotary oil vacuum pump (backing the diffusion pump)
63—Temperature indicator millivolt meter

Fig. 2—Schematic diagram of the plant layout, excluding electrical circuits, for nickel plating by thermolysis of nickel carbonyl in the vapour stage

vice versa. Reversal of flow can be effected at any time during plating without interruption of flow.

The gases and vapour extracted from the plating vessel cannot be directly pumped out since the presence of carbonyl vapour would soon render the rotary oil pump ineffective. The trap (28) is designed to remove residual nickel carbonyl vapour by thermal decomposition.

Operation

The metal object is degreased in organic vapour and pickled to remove any oxide films present. After rinsing and drying, the object is placed on the thermocouple stand and the bell jar placed in position. According to the size and shape of object, a bell jar, work coil and thermocouple stand of the appropriate sizes are selected. The vapour channels in the flange (43) are so designed that, with the aid of adaptor flanges, bell jars of a wide variety of sizes can be accommodated without any modification to the equipment.

The bell jar is evacuated by the backing pump (62) with the valves (48) and (59) closed and the valves (56) and (58) open. When backing pressures have been reached, valve (56) is closed and valve (59) opened. The plating vessel is then evacuated by the diffusion pump by opening the baffle valve (48). Heating of the object is commenced by switching on the H.F. generator (Fig. 1) and adjusting the output to the work coil to give the required rate of heating. It is usual to heat the object to a temperature somewhat in excess of the plating temperature, switch off the H.F. current, and allow the object to cool to near plating temperature before switching on the heating again.

With the object at the required temperature, vapour is allowed to enter the plating vessel after closing the baffle valve (48). Before this stage is reached, however, it is necessary to make certain preparations as follows:—

(1) Check the quantity of nickel carbonyl in the container and replenish if necessary.

(2) Pack the Dewar flask (3) with melting ice and allow carbonyl to reach ice temperature.

(3) Pump down the whole of the vapour system by opening all valves except (5), (22), (23), (24) and (25).

(4) Switch on the vapour trap heaters (29).

(5) Close the valves (12), (13) and (14).

(6) Open valve (5) and check pressure on gauge (6).

(7) Close valve (10).

Supposing vapour flow is required in a downward direction, the "by-pass" valve (26) is closed, and valves (22) and (24) are opened, the flow control needle valve (13) or (14) (coarse or fine control) being adjusted until the required rate of flow as indicated on the bellows manometer (8) is obtained. Total pressure in the plating vessel is recorded on the gauges (35) 0-10 mm., and (27) 0-100 mm. If diluent gas is used, the gas holder (18) is charged from the cylinder (15). Valve (16) is closed and valves (17) and (20) opened. When adjusting the flow of nickel carbonyl into the plating vessel, the flow of diluent gas is also adjusted by the needle valve (21) until the required flow recorded on the "rotameter" type of flow meter is obtained.

During plating it is necessary to check the vapour and diluent gas flows, and the temperature of the object, at intervals. At the end of the plating period the valves (12) and (20) and then valve (5) are closed, and the plating vessel and piping, etc., evacuated. Valves (22) and (24) are then closed and "by-pass" valve (26) opened. Valves (10), (12), (13), (14) and (21) are fully opened, and the vapour system up to valve (5) and diluent gas system up to valve (20) evacuated. The H.F. heating current is switched off and the object allowed to cool down to about 80°C. before admitting air to the plating vessel. Air can be admitted either via valves (60), (58) and (56), or via valves (32), (30) and (24). The bell jar is then raised through the work coil and the specimen removed from the stand with clean metal tongs. The bell jar is then

replaced, unless a further plate is to be carried out, and the whole system evacuated and valves closed.

Process Variables

The rate of deposition depends upon the rate of flow of nickel carbonyl through the plating vessel and the efficiency of the deposition process. Efficiency of deposition is normally high (about 80 per cent), but varies with temperature, rate of flow of vapour, linear velocity of vapour, etc., but is constant at fixed conditions of operation, and can thus be predetermined. The faster the rate of flow of nickel carbonyl vapour, the faster the rate of deposition and the lower the plating efficiency.

The pressure of operation is made up of three partial pressures: (1) the partial pressure of nickel carbonyl vapour, (2) the partial pressure of carbon monoxide resulting from decomposition of the carbonyl vapour, and (3) the partial pressure of any diluent gas, if employed. Within the limitations of a practical rate of deposition, the lower the total pressure the better, but a high ratio partial pressure of carbon monoxide : partial pressure of nickel carbonyl seems desirable.

The design of the equipment permits objects of a wide variety of sizes and shapes to be nickel plated by this process. For precision plating, i.e. thickness to ±10 per cent, objects should be treated singly, but where thickness tolerances are not important, and especially where very thin coatings are required, batch plating techniques are possible. Any metal whose melting point is above 230°C. can be safely nickel-plated, also graphite, ceramics, and the more heat stable plastics. In the case of non-metals it is necessary to apply a conducting coating if H.F. heating is to be employed, or, alternatively, infra-red heating can be used.

Design Considerations

Nickel carbonyl is a volatile liquid, boiling at 43°C., with a vapour pressure of 321 mm. at 20°C. The vapour is highly toxic (five times more toxic than carbon monoxide) and decomposes to give nickel and carbon monoxide.

$$Ni(CO)_4 \rightleftharpoons Ni + 4\,CO.$$

Decomposition commences slowly below 100°C. but increases rapidly thereafter. The reaction becomes slower in the later stages, due to the retarding influence of carbon monoxide, the concentration of which is building up all the time.

The low pressure method of operation of the process has a number of advantages, not the least of which is that the highly toxic nickel carbonyl vapour does not issue into the atmosphere should a leak develop in the equipment. Consequently, the plant can be operated safely in the laboratory or shop without any elaborate safety precautions, provided a safe type of container is used for the nickel carbonyl[5] and a suitable extract provided for the waste gas. A metal container for nickel carbonyl is the safest but suffers from the disadvantage that the amount of liquid present can not be seen. Perspex has been found to be a satisfactory material, although it is somewhat expensive to construct since the container has to be turned from solid bar, no joints being permissible. Containers from this material with walls 0·25 in. in thickness have been in use for five years without showing any signs of deterioration by contact with carbonyl liquid and vapour other than slight superficial crazing. Such a performance is considered to be highly satisfactory in view of the fact that the material not only resists attack from nickel carbonyl but also frequent immersions in dry-ice alcohol mixtures at −80°C., for the purpose of freezing the nickel carbonyl and pumping out residual air from the container before use.

As an additional precaution, however, the containers, when not in use, are always kept totally immersed in water in an outside store so that, should a leak develop, water will enter and prevent any serious release of vapour or fire risk. The pressure in the container, which remains free from air for long periods, never exceeds about 400 mm. The presence of water in the container is revealed during daily inspection and the presence of air by the line pressure gauge before plating is started.

For flow measurement, glass instruments are unsuitable, due to frangibility and the fact that, in time, nickel carbonyl vapour deposits a black film on glass which renders it opaque. Manometric liquids have the disadvantages of being prone to violent displacement with sudden accidental pressure changes, and nickel carbonyl vapour dissolves in most of them to give rise to errors in flow measurement. An all-metal flow meter with means for isolation and by-passing the orifice provides a suitable solution to the problem. This is achieved by employing a bellows capsule differential pressure manometer, which records the pressure difference across the orifice in terms of the spot deflection on a linear scale actuated by the optical lever principle.

To keep diluent gas flow steady, a constant pressure source of gas is as necessary as the constant pressure source of vapour for steady vapour flow. The best means for ensuring steady pressure is a gas holder as shown. High purity of gas supply is maintained by the presence of purifying reagents on the reagent tray provided in the gas holder. Important points in the design of the gas holder are the prevention of overfilling, with the risk of air entry, and inadvertent rise of oil (vacuum oil used) to the point of entry into the gas line.

The vapour trap removes vapour by thermal decomposition and has an advantage over a cold trap in as much that at the end of a plating operation there are no accumulations of toxic nickel carbonyl in the system. The temperature of the trap must be carefully regulated; it must be high enough to ensure that vapour removal is complete but not too high in order to minimize the formation of nickel powder as a sludge in the vapour pump oil.

Where high pressure of operation is required it is necessary to restrict the speed of pumping, and for that purpose a by-pass to the valve (30) is employed which contains a needle valve (31), enabling the pumping speed of the vapour pump to be controlled down to zero.

For convenience of operation it is necessary to have all controls as far as possible near to one another and centred around the plating vessel. Where this would involve extension of the piping system, valves have been arranged to operate on the end of a shaft. For each size of bell jar there is a corresponding H.F. work coil, adaptor flange and thermocouple stand. This ensures that the bell jar can be raised and lowered without adjustment of work coil, and that it is automatically guided on to the "0" ring seals by location on the base of the thermocouple stand.

The object to be plated is supported on three narrow metal supports, two of which form elements of a thermocouple for temperature measurement. These metal supports are insulated electrically and thermally from the metal parts of the stand by glass insulators. The insulators and supports are easily removed from the stand for cleaning off any nickel accumulated during the plating operation.

Properties of Coatings

The best quality coatings of nickel obtained by this process are comparable with the best quality (Watts bath) electrodeposited coatings. Thin coatings up to 0·5 mil in thickness are fully bright but coatings become matte as the thickness increases, the degree being more marked than in the case of electrodeposited nickel. The properties of the coating are markedly affected by change in plating temperature and the presence of air or oxygen. If the temperature of the object being plated falls much below 200°C., a brittle coating is obtained which is also dark in colour and velvety in texture. Depending upon conditions of flow the upper limit in temperature is set by the formation of soot-like deposits in the bell jar and, to a lesser extent, a decline in the throwing power of the process. Within these limitations, the best coatings are obtained at a plating temperature normally in the range of 210°-230°C.

Coatings of considerable thickness can be obtained (coatings exceeding 0·1 in. have been produced) at rates of deposition up to as much as 20 mil/hr.,

although at this rate of deposition there is some loss in quality of coating.

The porosity of the coating is again comparable with that of an electro-deposited coating of similar thickness, and adhesion problems might be regarded as somewhat similar in that a substrate of metals with low affinity for oxygen, e.g. copper, offers less difficulty than those with a high affinity, e.g. aluminium.

Hardness of the coatings varies over a fairly wide range, normally being between 150 and 250 D.P.N., but a hardness as low as 100 D.P.N. and as high as 350 D.P.N. can be obtained. If air or oxygen is added to the vapour, the hardness of the coating can be increased to 850 D.P.N. In general, ductility follows hardness, deposits approaching 830 D.P.N. scarcely withstanding slight flexure whilst some coatings in the lower hardness range withstood twenty 180° bends on a Jenkins bend tester.

Acknowledgment is made to various colleagues at the Atomic Weapons Research Establishment who contributed to the experimental work, and to Mr. G. L. Hopkin, Chief of Materials, and Mr. W. B. H. Lord, Superintendent of Metallurgy, for their interest and advice.

References

1 J. J. Lander and L. H. Germer; A.I.M.E. Tech. Pub. No. 2259. Classes C. and E. *Metals Technology*, 1947, Sept.

2 B. B. Owen and R. T. Webber; A.I.M.E. Tech. Pub. No. 2306. Class E. *Metals Technology*, 1948, Jan.

3 *Chemical Engineering*, 1949, Oct., 118.

4 U.K. Patent Application No. 11438/56.

5 U.K. Patent Application No. 34988/57.

PROGRESS IN HEATING FOR METAL MELTING AND THERMAL TREATMENT

Fuel Efficiency

(*Continued from* METAL INDUSTRY, 14 *March*, 1958)

FOLLOWING opening addresses by **Mr. F. C. Ashen** and **Mr. P. F. Hancock,** the recent meeting organized by the Institute of Metals on "Fuel Efficiency in the Melting and Thermal Treatment of Metals" was thrown open for more general discussion. The meeting was held at the College of Technology, Gosta Green, Birmingham, and the opening addresses were published in our issue of 14 March. The first part of the informative discussion is given here, and further extracts will appear next week.

DISCUSSION

A. Higgs (West Midlands Gas Board):

Both the opening speakers have rightly emphasized the importance of achieving a high thermal and process efficiency, and the West Midlands Gas Board, in common with many other Area Gas Boards, regard the achievement of a high thermal efficiency as a primary requirement in all industrial gas applications, and continuous attention is given to the development of new techniques of firing, calculated to contribute to this objective.

As is perhaps well known, the selection of refractories can have a significant effect on performance. This applies particularly to furnaces operating intermittently. To take extreme examples, in a furnace operating over a 10 hr. period at 1,000°C., having a wall with a thickness of 6 in. composed of insulating refractory, each ft² will require approximately 8,500 B.Th.U. to satisfy the thermal capacity and heat loss requirements. As against this, a ft² of furnace wall composed of 4½ in. of Selfrac behind 13½ in. of firebrick will require, over the same period, 55,000 B.Th.U. Applying this simple example to a furnace having 20 ft² of internal surface area, one with 13 in. of firebrick backed with 4½ in. of insulating refractory will require 18·6 therms over a 10 hr. period at 1,000°C., whereas a furnace of identical surface area, but constructed with a wall thickness of 6 in. of insulating refractory, will require only 2·8 therms. This example illustrates the importance, in furnaces operating intermittently, of correctly determining wall thicknesses and selecting refractories.

The saving quoted is, of course, the maximum, and assumes that the furnaces are cooled to room temperature, whereas in practice the furnace with the high thermal capacity, assuming good damper control, may well be between 200°-300°C. the following morning. Even if an allowance as high as 30 per cent is conceded for this residual heat, however, there is still a very substantial saving.

This, of course, is only one of the factors contributing to fuel efficiency in intermittent furnaces, and the complementary factors must not be overlooked. The sizing and disposition of flueways are important, and they should, wherever possible, be so arranged as to give a good heat distribution, maintaining the furnace, with direct heating, full of combustion products. The siting of flues so as to afford a natural chimney effect on the furnace must be avoided. Automatic and accurate control of the air/gas ratio is another important factor from the standpoint of fuel economy, and much waste, in our experience, arises from the employment of two-cock control, due to the maladjustment of the air/gas ratio by operatives. The contribution which proper instrumentation can make — particularly temperature controllers and, to a lesser degree, pressure controllers—should not be overlooked.

In practice, the substitution of insulating refractory linings, in conjunction with the employment of air/gas proportioning burner equipment with correct design, has effected substantial savings. One example is a reverberatory holding furnace (of which there are large numbers) for aluminium alloy, of 1,500 lb. capacity, having an average output of approximately 400 lb/hr., which consumed 48 therms per day of 24 hr. prior to reconstruction or redesign. With added insulation, re-arrangement of flueways, and the employment of multiple air/gas proportioning burners, this gas consumption was reduced to 28 therms per 24 hr. The fitting of air/gas proportioning burner equipment has achieved appreciable savings on many furnaces. On a range of hot brass stamping furnaces where the only modification was the fitting of this type of burner equipment, dealing with brass slugs heated to 850°C., the gas consumption/lb. was reduced from 7 to 3 ft³, a saving of the order of 60 per cent.

On aluminium bale-out and tilting furnaces, insulating refractory has proved very satisfactory when applied to the higher courses of brickwork. This arrangement, again in conjunction with air/gas proportioning burner equipment, has achieved a reduction of 64 per cent in fuel consumption, from 19·3 ft³/lb. to 7·04 ft³/lb. These furnaces are used for melting from cold and the "take-off" is relatively low, which accounts for the still high gas consumption per lb. of metal "take-off." In other bale-out furnaces fed with hot metal where these designs are used, holding consumptions of 0·67 ft³/lb. with a high take-off, and 1 ft³/lb. on initially melting out to 700°C., are being obtained.

Ashen has referred to concentrated combustion burners. Much publicity has been given in the technical press recently to the subject of jet burners. Basically, the concept of high velocity burners—for that is what they are—emanates from Birmingham, such burners being termed concentrated combustion (C.C.) burners, and many of you will know that the original work was done by J. Palmer. The essential difference between the C.C. burner and the jet burner is the employment by the jet burner of a converging refractory combustion tunnel in place of the parallel-sided tunnel. The C.C. burner is based on the use of a refractory combustion tunnel having a fixed ratio of 6:1 (1 in. dia. and 6 in. long). On the jet burner, this tunnel is arranged to converge, the termination being determined by what it is desired to achieve in the way of issuing velocity. It is, of course, necessary to increase the mixture pressure to overcome the increased resistance occasioned by the use of a converging tunnel, but the arrangement in actual furnace practice enables a very high terminal velocity to be achieved. Heat releases of the order of 160 million B.Th.U/ft³ of combustion space have been achieved, with issuing velocities in the region of 1,800 ft/sec. Slots or circular terminations can be provided in such burners to suit different applications.

Applications in industry so far have been made in the main to furnaceless heating procedures, such as the continuous lap welding of steel tubes, the heating of spring plates prior to punching, and the heating of steel sections prior to forming, and so on.

(*Continued on page* 234)

NEW EQUIPMENT AT NORTHERN ALUMINIUM COMPANY'S ROGERSTONE WORKS

Large Aluminium Plate

PROVIDING advanced facilities for the production of high-quality aluminium plate, five new items of capital equipment have gone into production at the Rogerstone, Monmouthshire, works of Northern Aluminium Company Ltd. These installations result from two distinct developments, to meet diverse industrial needs—the aircraft industry's demand for thick, high-strength aluminium alloy plate for machining into integrally-stiffened wing skins and similar aircraft parts; and the shipbuilding industry's call for aluminium plate in the medium-strength alloys, in sizes wider than have hitherto been available. The expansion will undoubtedly mean increased freedom of design wherever aluminium plate is used, in these and in other industries as well—for example, in chemical engineering, atomic energy, and railway engineering.

Plate Welding

The new equipment for the production of wide plate enables the company to offer aluminium plate up to 11 ft. wide by about 30 ft. long, whereas limitations of rolling mills have hitherto restricted aluminium plate made in this country to a width of about 7 ft.

Wide aluminium plate, which is available in the non-heat-treatable alloys such as Noral 2S, B54S and M57S in thicknesses up to 0·4 in., is made by butt-welding two plates together in a process that allows the final plate to be regarded, for virtually all welded work, as normal rolled plate.

The equipment consists essentially of a 35 ft. long concrete base, carrying the welding jig. The two pieces of plate to be welded are placed flat, edge-to-edge (with an appropriate welding gap) on the jig, which holds them firmly in place. The overhanging part of one piece of plate is supported on trestles, the other by a plate turn-over table.

The welding is carried out by an Argonaut welding head operating fully automatically on a self-propelled carriage. The welding speed is generally between 50 and 150 in/min.

After completion of the weld, which is made in one pass, the top weld bead is removed and the plate lifted off the welding rig by an overhead crane. The plate turn-over mechanism then reverses the plate for removal of the under-bead.

For producing thick high-strength plate to meet the requirements of the aircraft industry, new equipment includes plant for ultrasonic testing, a large plate saw, heat-treatment furnace and plate stretcher.

Ultrasonic Testing Equipment

The ultrasonic testing equipment makes use of the most modern developments to ensure complete examination of the material. Designed and built by the Curtiss-Wright Company, the "Immerscope," as the equipment is known, enables the plate to be inspected in fully-immersed conditions — a method that ensures complete examination of the entire plate except for a thin "dead" zone comprising the top 0·1 in. of the material under test.

For examination, the plate rests in a tank of water 14 ft. wide, 3 ft. deep and 54 ft. long. The inside of the tank is hot-sprayed with zinc to prevent corrosion. The probe unit, by which the ultrasonic wave is directed into the metal, is mounted on a carriage which, in turn, is carried on an aluminium scanner bridge of lattice construction, running on rails at each side of the tank. In this way the whole plan of the tank can be covered by the probe, the carriage traversing the bridge in the same manner as the bridge travels the length of the tank. The probe unit can also be raised and lowered according to the thickness of the plate under examination.

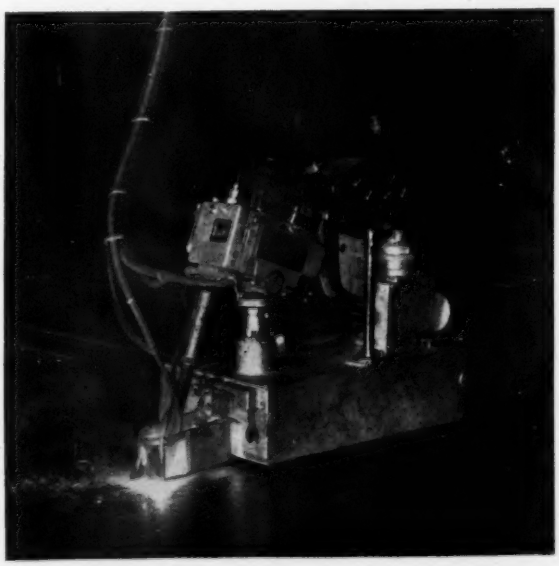
Bridge and carriage motions may be automatic, or manually operated by switches, and their speeds are infinitely variable from 5 ft/min. to 90 ft/min.

Of the two "scans" as they are termed, the first ("A") supplies two-dimensional pip-type echo information at the first oscilloscope, telling the operator the depth in the metal at which the flaw has been found and its size. Size is indicated by the amplitude of the trace, while depth is shown by relating the position of the echo on the screen to those echoes received from the top and bottom plate surfaces.

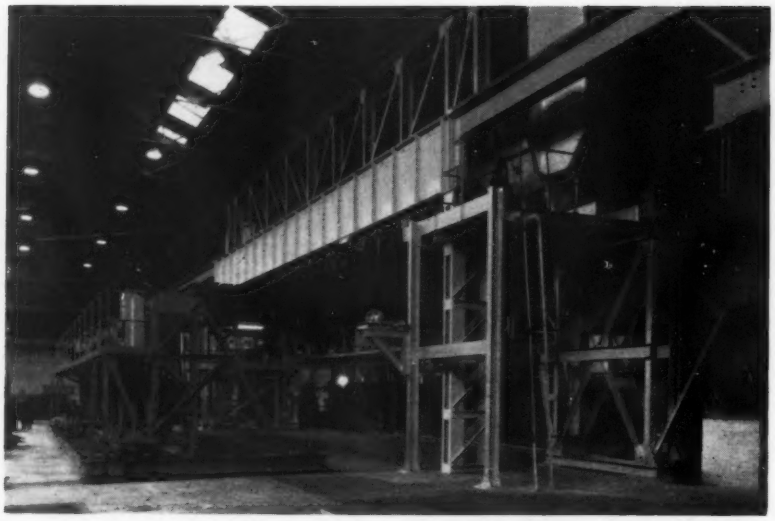
The second, the B-scan, enables the operator to see a longitudinal or transverse section of the plate being inspected, the top and bottom surfaces being represented by bright horizontal traces on the screen and defects being indicated by bright spots. By correlating this information with that received at the A-scan, a complete picture of the flaw and its position is obtained. To ensure that no flaw is overlooked (by failure to notice the "pip" on the screen, for example), the controls can be set so that scanning is automatically stopped when an echo signal is detected.

Plate Heat-Treatment Furnace

For the heat-treatment (i.e. both solution treatment and artificial ageing, as well as annealing) of aluminium alloy plate, the furnace is of the bottom-loading type, with a quench tank immediately below the furnace chamber. This furnace, designed and built by Stordy Engineering Ltd., was chosen as giving the best answer to the problems arising in heat-treating aluminium alloy plate of the sizes contemplated. Its capacity is nearly 20



Automatic Argonarc welding in progress at Rogerstone, using a technique that ensures complete freedom from distortion



A general view of the Stordy furnace for the heat-treatment of aluminium alloy plate. The furnace is bottom-loaded by means of the charger seen on the left

tons of plate for ageing at temperatures up to 200°C., without quenching; 10 tons for solution heat-treatment up to 550°C., with a slow quench; and 5 tons for solution treatment up to 550°C., with a high-speed quench. It forms an essential part of the complete aluminium plate production facilities laid down at the Rogerstone works and, like the rest of the equipment, is designed to handle plate up to 55 ft. long, 10 ft. wide and 6 in. thick.

The furnace is electrically powered and fully air-circulated, the heater batteries and fans being mounted at each end, outside the furnace chamber.

The furnace is of special stainless steel lined construction, entirely without refractories. Asbestos-sealed sliding joints in the furnace casing allow for expansion.

The furnace door and its mechanism are of special interest. The door itself, insulated in the same way as the furnace and similarly lined with stainless steel, is made of a number of 6 ft. square sections joined to make one continuous door. Sealing in the closed position is maintained by asbestos cord, carried in heat-resisting castings round the edge of the door. When the door is closed, this cord is pressed against corresponding castings around the opening in the bottom of the furnace.

The operation of opening or closing the door involves two distinct actions, a moving into position and a sealing or unsealing action. The door is mounted on toggles, which are operated, through linkages, by two hydraulic cylinders and serve to raise or lower the door through a few inches for sealing or unsealing. The whole door and its sealing mechanism are, in turn, mounted on a carriage which spans between rails 60 ft. apart. To close or open the door, the entire carriage is electrically driven about 8 ft. along the rails. When the door is in the closed position, brackets are engaged so that the forces exerted by the sealing operations are carried by the main furnace steelwork and are not transmitted to the door carriage.

The furnace load is carried on seven full-length joists, one piece of plate being supported by each joist. The joists rest on four short transverse bearers, which are attached at their ends to hoist chains. These pass through the roof of the furnace and over pulleys to drums mounted on a shaft at the rear of the furnace.

The control gear is set so that all loads are raised into the furnace at 20 ft/min., while lowering can be carried out at 20 ft/min. or at the quenching speeds of 90 or 180 ft/min. Safeguards are provided in the control mechanism so that loads weighing over 10 tons can be lowered only at 20 ft/min., and no load weighing over 5 tons can be lowered at the fast quench speed.

A furnace charger, running on rails at each end of the furnace and spanning the quenching tank, is used for loading.

The quenching tank, immediately below the furnace and sunk into the floor, is of concrete, and measures overall 102 ft. long, 10½ ft. wide and 15 ft. deep. Much of this length and width are occupied by circulating pumps and passages, however, and the useful size of the tank for quenching purposes is 60 ft. long, 6 ft. wide and 15 ft. deep.

Plate Saw

As the available sizes of materials increase, the problem of accurate cutting to the required dimensions becomes correspondingly great. To meet this problem, not only for the very large sizes of aluminium plate being produced at present, but for the even greater sizes likely to be required in the foreseeable future, the company has installed a large saw.

Difficulty arises with such large pieces of material in keeping them squarely, accurately and firmly located relative to the cutting blade. A new approach to this question is embodied in the new saw, which was built by Wadkin Limited, of Leicester.

Surmounting the machine, and completely spanning the plate to be cut, is a single box-section beam, 68 ft. in length between its pin supports, 6 ft. deep at the centre of its span, and weighing about 20 tons. Within the beam are carried 18 pairs of hydraulic jacks, which hold the aluminium plate to the table. The plate is cut by a circular saw which travels beneath the beam, traversing its length; the saw blade is located beneath the centre of the beam's cross-section and projects upwards between plate conveyor tables.

The saw is driven by a 75 h.p. motor housed in a 14 ft. long saddle, which also carries the 6¼ h.p. feed motor. The saddle rides on two flat longitudinal bearing surfaces, and passes through the arches of the massive beam supports at each end of its travel.

For moving plate to be trimmed into position beneath the beam there are seven infeed and seven outfeed conveyors projecting at right-angles to the beam and on each side of it, each 2 ft. wide, 12 ft. long, and driven by a 1½ h.p. motor. The surface height of the conveyors (and hence the working height of the plate when being sawn) is 2 ft. 6 in. above floor level. The plate conveyors were built by the Albert Mann Engineering Company Limited, of Basildon.

In order to ensure an accurate square cut when end-sawing, a straight edge is fitted along the length of the first pair of conveyors, at right-angles to the line of saw cut.

Considerable development work has gone into the design of the saw blade itself, and very high feeds and speeds can be employed. For example, plate in Noral 2S (commercially-pure aluminium) and Noral 26S (a high-strength aircraft alloy containing copper), 6 in. thick, has been sawn at a feed speed of 90 in/min. with a saw peripheral speed of 10,000 ft/min. Thinner plates can be cut at greater feed speeds, and material of 3 in. and below can be readily cut at 180 in/min.

Plate Stretcher

The new stretcher is intended specifically to meet the growing need for large stress-relieved aircraft plate. This large plate must be free from locked-in heat-treatment stresses. Relieving these stresses necessitates a controlled stretching operation, and the new machine will provide the means for carrying out this operation on the very large pieces of plate now required.

The stretcher, a machine with a rated pull of 4,000 tons, is capable of

applying a controlled stretch to light-alloy plate up to 50 ft. long, 10 ft. wide, up to 6 in. thick, and with a maximum cross-section area of 200 in^2. It was designed and built by the Loewy Engineering Company Limited, of Bournemouth.

In the stretcher, one end of the plate is gripped in a fixed head, the other end in a sliding head; the sliding head is forced away from the fixed head by the action of two hydraulically-operated rams, and as it moves the plate is stretched by a predetermined amount.

To carry out this operation on such a scale calls for considerable development of design, and the stretcher incorporates several new features that form the subjects of patent applications.

The stretcher consists of two main compression members, which are placed one on each side of the machine; in side elevation, these are level with the centre-line of stretch. Directly on the ends of the compression members are mounted the two main hydraulic cylinders, with rams bearing on side extensions of the main grip-head. This head is carried on horizontal bearing surfaces, and moves during the action of stretching.

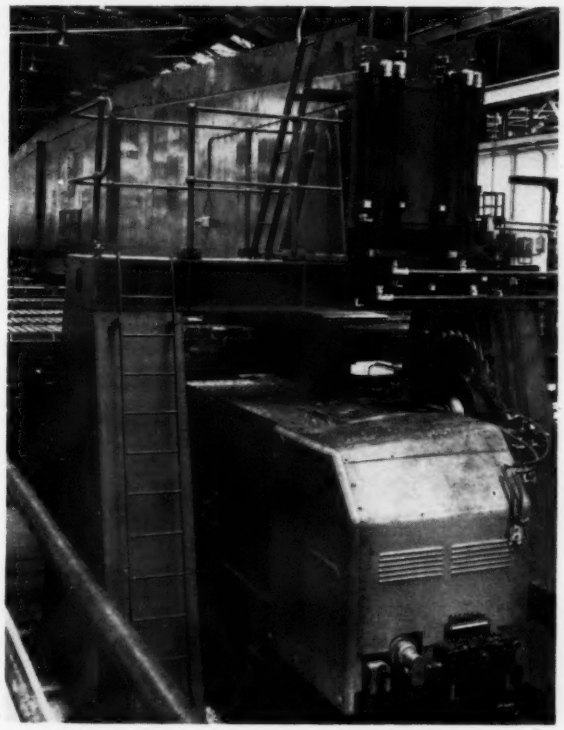
The tail grip-head, on the other hand, is fixed relative to the compression members during stretching. So that pieces of plate of various sizes can be accommodated, however, this head is adjustable along the compression members. For this purpose there are nine anchor holes in the compression members, at 4 ft. 6 in. pitch, in which the head is locked according to the length of the plate.

Adjustment of the position of the head is made in a series of 4 ft. 6 in. steps, by ram-operated tow-bars sliding inside the compression members. In this operation, tow-bar pins fitted in the head engage with the tow-bar for the movement of the head, and then disengage to allow the tow-bar to return for the next step. When the head is in the required position, overstroke rams facilitate the engagement of the anchor pins in the holes in the compression members.

The two main stretcher rams are of 36½ in. diameter and have a 7 ft. 6 in. stroke. To effect a fast advance and return of the main head when not stretching, the main cylinders are not used; instead, the head is moved by double-acting 8 in. diameter rams acting on the main head.

A continuous disappearing apron is attached to the adjustable head. This serves to fill in the space between the heads and also acts as a support for the plate prior to stretching. For the latter purpose it is fitted with free-running rollers on which the plate can be moved longitudinally. Once the plate is placed on the apron, manipulation into the grip heads is entirely independent of outside help. Devices are provided on each head for raising the plate ends to facilitate entry into the jaws, and also for plate centring. Lengthwise positioning is by means of plate locating stops within the jaws.

Above: The two control panels of the Wadkin high-speed plate saw

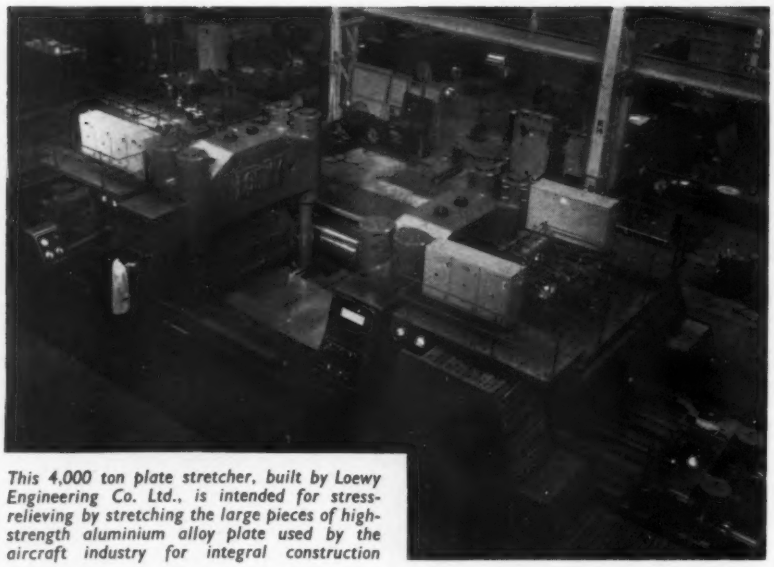


Right: A general view of the Wadkin high-speed plate saw. In the foreground is the saddle carrying the sawing disc; when cutting, this saddle traverses beneath the 68 ft. 20 ton beam, which carries 18 pairs of hydraulic jacks for holding the plate

The grip jaws of both heads are in ten segments, which do not have to be changed for different plate thicknesses. Each top and bottom pair of segments is mechanically centred, and all are able to move to a small degree relative to each other to accommodate a degree of variation in the thickness of a plate. To give the heavy initial "bite" necessary to hold the plate, the jaws are moved by 400 ton hydraulic rams.

The depth of penetration of the plate in the head, and hence the length of grip, is determined by the plate locating device, which has two appropriate preset positions. These positions are selected according to the width and thickness of plate.

In addition to jaw segment movement, the main head is capable of a limited angular movement to allow it to take plate that might be slightly wavy along one edge. This feature also tends to make the gripping of the plate easier.



This 4,000 ton plate stretcher, built by Loewy Engineering Co. Ltd., is intended for stress-relieving by stretching the large pieces of high-strength aluminium alloy plate used by the aircraft industry for integral construction

The machine has three separate oil hydraulic systems, one on each grip-head and a main one in the foundation supplying the main cylinders, the advance-and-return cylinders, and the tow-bar rams.

All controls necessary for the operation of the stretcher are mounted on control desks, carried on each head. On the main head control desk, in addition to the pistol-grip and push-button hand controls, is a stretch indicator. This shows the length of plate between the jaws and the amount of elongation applied. The degree of stretch can be preset at 1, 1½, 2, 2½, 3, 4, or 5 per cent, and the operation will automatically stop as soon as the pre-set value is reached. As an alternative, provision is made for stretching to a predetermined stress.

An important feature of the machine's design is that it is protected from shock damage should a plate break while being stretched. When the plate breaks, the grip heads are accelerated outwards, and the two broken parts of the plate are projected into the heads. Large pressure relief valves protect the tow-bar cylinders, the main head advance cylinders and the jaw cylinders, and stop the outward movement of the heads. During the outward movement, the foundation is protected from shock by compression-member centring cylinders, into which are built relief valves. Movement of the whole stretcher structure relative to the foundation is thus possible. Residual shock loads remaining after hydraulic damping are finally transmitted to a pre-stressed concrete beam built into the foundation. The attachmen of the stretcher to this beam by means of two tie rods is the only longitudinal fixing for the entire machine. After displacement caused by plate breakage, all parts can be returned hydraulically to the normal position relative to the foundation.

Fuel Efficiency—*continued from page* 230

Improvements resulting from the application of other types of new burners, and particularly those having a multiplicity of small flames, with primary and secondary air supplies, and the inclusion of an arrangement whereby it is possible to switch over from primary to secondary at will, with full aeration, which, of course, enables the flame characteristics to be varied at will, are also being studied, all with the general objective of increasing thermal efficiency.

Th. Teisen (Teisen Furnaces Ltd.):

Broadly speaking, the ultimate goal of furnace engineers is to produce the maximum quantity of the required quality at the lowest fuel cost. As processes and methods vary a great deal in various stages in industry, it is desirable to differentiate between actual furnace efficiency and performance figures. They are often mixed, with conflicting results.

Higher furnace efficiency is obtained, for instance, as we have just heard, by making use of insulating materials wherever possible, thus reducing the heat losses through the surrounding brickwork. There is still plenty of scope here, but what is done should be carried out with full regard for the conditions in the furnace, so that refractory wear does not become excessive, or nothing will be gained, as Hancock has said. Refractory insulation can be used in some cases, but is mainly suitable for electric furnaces rather than for gas- or oil- or coal-fired furnaces, of which a few are still left!

Another consideration is correct combustion control, with minimum use of excess air. This has been mentioned, and is frequently referred to in the textbooks. The regulating facilities should, of course, be adequate for such close control, so that the correct proportioning of fuel and air is maintained throughout the fuel flow ranges. Such facilities may in many cases, in heating and heat-treatment plant, be so accurate as to provide in effect a controlled atmosphere in the furnace, which means that there is less scaling or similar effects on the metal which is treated.

There is a tendency to differentiate between the controlled atmosphere used in ordinary gas-fired or liquid-fuel-fired furnaces and the protective atmosphere found in some other furnaces, as, for example, inert gases in a closed muffle furnace or an electric furnace. A controlled atmosphere can be achieved by using one of the modern types of furnace now available, and this also leads to improvement in the type of metal put through the furnace; closer tolerances can be used, and surface finishing after treatment can be reduced or abolished completely.

Good instrumentation helps a great deal to establish easy reference to the actual conditions in the furnace. A step further is the introduction of automatic control of temperature, which has been proved to reduce fuel consumption.

Heat recovery systems are some of the most important methods of achieving substantial fuel efficiency. If the temperature in °C. of preheated combustion air (vertically) is plotted against the sensible heat (horizontally) an ordinary linear function results.

The method of heat saving in this way is shown in the use of regenerators, though this is seldom found in the ferrous and non-ferrous industries except for steel melting; but recuperators are used a great deal. The percentage saving in the fuel should also be shown, and this can be plotted horizontally instead of B.Th.U. This will show a saving of approximately 20 per cent at 400°C., rising to, say, 30 per cent at about 900°C. and then rounding off, on account of the greater heat transmission which was obtained by reason of the higher flame temperatures.

Metal recuperators or refractory recuperators may be used. Metal recuperators can be used up to a pre-heated air temperature of 500°-600°C., but with refractory recuperators it is possible to go up to 1,000°C., allowing for waste gas temperatures of up to 1,400°C. The cost is usually less than with metal recuperators and the life longer. Such recuperators have been built for many years, and good results have been obtained. Refractory recuperators are known to have been in continuous operation for five to ten years.

To compare the same types of furnace it is often more convenient to evaluate a no-load fuel consumption with the furnace running at a specific temperature, where the factors just mentioned are incorporated. Having taken these points into consideration, there are the load factors controlling the size of the furnace and the specification, and here, of course, there is a tendency to have improved efficiency with increased load factor. That can be expressed as weight per area per time unit, and these vary so much that it is often quite difficult to make comparisons, so that in such cases reference is made to no load.

(*To be continued*)

EQUIPMENT AT THE EXHIBITION OF THE PHYSICAL SOCIETY

Scientific Instruments and Apparatus

ON Monday next, March 24, the 42nd exhibition of The Physical Society will be opened at the Old and New Halls of the Royal Horticultural Society, Westminster, London, by **Professor N. F. Mott,** M.A., D.Sc., F.R.S., President of the Society. The exhibition is again being well supported, and many new developments and improvements in the fields of instrumentation and scientific aids to industry are to be seen among the various exhibits. The exhibition will remain open until 4.30 p.m. on March 27.

Space does not permit of a complete review of all these exhibits, but we are able to give below a summary of many of those exhibits which should be of much interest to the non-ferrous metal and allied industries.

Accles and Pollock Ltd. This Birmingham concern has a number of interesting items on view. Examples of finned sections for the "canning" of uranium are shown. Materials include aluminium, magnesium-aluminium alloy and niobium. Then there is seamless helically convoluted flexible tubing in various sizes; most of this tubing has so far been produced in austenitic stainless steel, but it can be made in other metals (including non-ferrous). Samples in Inconel, titanium and zirconium are being shown. Special thin walled tubing, capillary tubing and pointer tubes are also on view, as well as composite tubing.

Associated Automation Ltd. On this stand will be seen a micro hardness tester designed for use with a standard bench type metallurgical microscope for the measurement of the hardness of materials microscopically at determined points. This instrument can be used equally well for laboratory measurements and inspection, and production quality control.

Baird and Tatlock (London) Ltd. The latest development in this firm's "Analmatic" range of instruments is an analyser for grouped individual samples. It has been designed for those cases where complete automation of the whole process is not required, and also where the individual samples are needed for other purposes after the analytical sequence has been completed and the results recorded. Then there is the new B.T.L. electrolytic analysis apparatus, which has been designed to meet the requirements of laboratories using rotating electrode techniques in metal analysis. The basic apparatus provides for three entirely separate depositions to be carried out at the same time, factors such as deposition current and electrode rotation speed being independently variable on each unit.

Baker Platinum Division: Engelhard Industries Ltd. This company provides an interesting exhibit which includes the S.R. type platinum alloys. This series combines the catalytic properties of platinum-rich alloys with exceptional resistance to grain growth and deformation at very high temperatures. They are prepared by a special powder metallurgical process, and incorporate minute traces of a highly dispersed refractory oxide. The automatic aero engine gas turbine re-igniter plug is typical of the service for which these alloys may be used, and a graphical illustration will be provided by the demonstration unit on display. There will also be shown developments in thermocouple wires, including the new "Fibro" thermocouple.

Baldwin Instrument Co. Ltd. Included in the display made by this Kentish company is an example of their Atomat nucleonic thickness gauges. A standard single-channel Beta gauge will be demonstrated, and this consists of a beta-emitting radioactive source directing radiation at an ionization chamber, the output from which feeds directly into a highly stable D.C. amplifier.

British Thomson-Houston Co. Ltd. A number of interesting items are being shown by the research laboratory of this company. Of particular interest will be a thermocouple for the measurement of high temperatures. This is a unit suitable for the measurement of temperatures of up to 3,000°K. It has been made from tungsten and a tungsten-rhenium alloy. Operated under vacuum or in inert atmosphere, this is of great use in high-temperature research where the use of optical or radiation pyrometers is precluded. Demonstrations will be given on the stand.

Cooke, Troughton and Simms Ltd. From this Yorkshire company comes an exhibit which includes an inverted metallurgical microscope which has a self-contained illuminator and a quintuple objective changer; the stage is of the gliding type. The focusing mechanism is contained within the casing, which serves as a column for supporting both the microscope and the limb. The coarse and fine motion controls are arranged concentrically The instrument is offered alternatively with binocular and monocular bodies.

Dawe Instruments Ltd. Among the items to be exhibited by the company is the type 1108 Visigauge, a production version of the prototype shown at last year's exhibition. This instrument measures the thickness of material from one side by determining the fundamental natural frequency of vibration in the thickness direction. The thickness is indicated directly on a 21 in. cathode ray tube, the discriminations being such that dimensions can be compared to within 0·1 per cent. Then there are the type 1150 ultrasonic cleaning equipment and the type 1151 Soniclean ultrasonic generator, which is a high power version of the former type. The Soniclean has a peak output of 4 kW. It will drive eight type 1161/B36 immersible transducers, having a total radiating surface of about 340 in^2. This provides uniform ultrasonic cavitation in 20 gal. of cleaning solution.

Edwards High Vacuum Ltd. A large range of products is contributed by this Crawley company. A new vacuum fusion gas extraction and analysis equipment is a completely self-contained unit for the vacuum extraction and analysis of gas in metal samples. Then there is the latest version of "Telegas" instrument, an improvement on the model previously shown. It incorporates various improvements as a result of field experience and is likely to prove an invaluable instrument for the determination and control of hydrogen in aluminium, and hence control of porosity, etc. Also to be seen is a new high-sensitivity leak detector, applicable to outward leakage and vacuum apparatus.

Elliott Brothers (London) Ltd. An exceedingly wide range of instruments is being exhibited by this company, including computers, vacuum equipment, vibration control equipment, multi-channel strip chart recorders, and industrial frequency indicators.

English Electric Valve Co. Ltd. Included in the display on this stand will be the range of E.E.V. germanium power rectifiers, and a new 65 kV high-vacuum rectifier.

General Electric Co. Ltd. From the research laboratories at Wembley of this company come a number of interesting units for use in the metal fields. Several large single crystals of germanium, each weighing 5 kg., are being shown. These are standard production crystals, and by growing crystals of this size it is possible to produce, at the minimum cost, the highest yield of material suitable for semiconductor devices. There is also being shown a radiation pyrometer which has three principal uses. First, as a direct radiation pyrometer it will detect and measure temepratures down to 100°C. Secondly, with a double pinhole collimator, it may be used to trace isothermals and temperature gradients around a source, as in welding or continuous brazing. Thirdly, fitted with a radiation collecting probe, it may be used for measuring high temperatures where the source cannot be viewed directly owing to obscuring media, such as quench oil or smoke.

Griffin and George Ltd. On this stand will be exhibited several pieces of equipment embodying modern scientific techniques. One exhibit is the new Griffin-B.C.R.A. isothermal bomb calorimeter, with which routine continuous calorific value determinations on coal, coke, oils, etc., to the highest accuracy can be achieved. A comprehensive work-studied design of calorimeter has been embodied in a functional bench on which all controls are within easy reach, the operator remaining seated throughout the routine.

Hilger and Watts Ltd. By adjusting two mirrors, which have been introduced into the optical system of the Hilger Medium Quartz Spectrograph, the spectrum can be sent at a moment's notice to any one of three focal planes. This unit is one of the exhibits provided by this firm. This new instrument is very flexible and can be set for several analytical programmes; for example, one direct-reading compartment can be arranged for analysing aluminium alloys and the other for magnesium alloys, while the photographic attachment can be used for occasional analyses of other materials.

Isotope Developments Ltd. A number of instruments will be seen on this stand, among them being a wall thickness gauge, type 875, a portable instrument depending on "back-scatter" of gamma rays. It indicates wall thickness when brought into contact with only one side of flat plates, or with the outside surface of pipes and other cylindrical vessels. It is useful for checking for internal erosion or accumulation of scale.

Johnson, Matthey and Co. Ltd. A variety of electrical contacts in a number of different alloys may be seen on this stand. Included are the standard ranges of headed contacts, button contacts for resistance welding to their supports, and the recently introduced tubular contacts. Also, the Mallory 73 beryllium-copper for spring applications, and Mallory 1000, which is a machinable tungsten-base alloy having a specific gravity of 16·9. In addition, noble metal electrodeposits on printed circuits and also noble metal thermocouples. Examples of precision drawn resistance wires in a wide variety of metals are also to be shown. The base metals include copper-nickel and 80:20 nickel-chromium alloys, and the proprietary alloys Minalpha, Mancoloy 10, and an entirely new alloy having a specific resistance some 50 per cent higher than 80:20 nickel-chromium.

Kelvin and Hughes Ltd. A variety of instruments will be seen on this stand, including instrument motors, governed A.C. gyroscope, pressure capsules of welded construction, an hermetically sealed switch, a multi-turn slide wire resistor, and a cone and cylinder integrator.

Metropolitan-Vickers Electrical Co. Ltd. From this company will come the EM6 electron microscope, which incorporates the latest advances in electron optics and includes extensive facilities for transmission, reflection, stereo-microscopy and micro-diffraction. This instrument has a guaranteed resolving power of 15Å or better. The condenser lenses enable fine illuminating spots to be obtained and direct magnifications ranging from ×1,000 to ×100,000 are possible. Two spectrometers will also be on show, and other exhibits on this stand will include a digital voltmeter, a Newton Victor "Raymax 60" X-ray diffraction unit and a Metrovick 3 in. oil diffusion pump.

Morgan Crucible Co. Ltd. Examples of this company's silicon carbide-graphite thermocouple will be exhibited. This thermocouple consists of an inner graphite rod cemented into an outer silicon carbide tube, approximate dimensions ¾ in. diameter by 12 in. long. It should be possible to use the thermocouples to temperatures of about 1,900°C. without a protective sheath. In addition, voltages in the order of 250-500 millivolts are obtained in the range 1,000-1,900°C. The H.F. Titrimeter will also be included. This instrument is used for the detection of end-points in solution where visual indicators cannot be used or give unsatisfactory end-points (e.g. the titration of coloured solutions or the titration of fluoride with thorium nitrate). It is basically a 2 Mc/s crystal controlled oscillator which gives a stable excitation signal to the solution in the glass titration cell via the copper band electrodes, which do not come into contact with the solution.

Mullard Ltd. A wide variety of instruments will be seen on this stand and a demonstration of ultrasonic cold welding will be given. This is a new technique for welding together a range of similar and dissimilar metals. The weld is achieved by the introduction of up to 2 kW of ultrasonic energy at 20 kc/s into the area to be bonded. Only relatively low static pressures are applied to the work, and consequent deformations are small.

Murex Ltd. A large bayonet heater in tantalum is to be exhibited on this stand, as well as articles fabricated in niobium. A method of forming dishes and crucibles by spinning has recently been applied to tungsten, and examples of these spinnings will also be shown. Molybdenum spinnings in larger dimensions are also available and large molybdenum rods for furnace electrodes are being produced. An example of the fabrication of molybdenum and tungsten will be shown in the form of an element for a heating unit for temperatures up to 1,800°C. Reactor grade zirconium sheet is being shown for the first time and is available in small quantities. The company's range of sintered permanent magnets, including Sincomax magnets of the "sandwich" type, has been extended considerably. These magnets, with their good mechanical properties and consistent magnetic properties, find a wide range of application in instrument manufacture and in other applications where physical strength is essential.

Nash and Thompson Ltd. Among the items displayed on this stand will be the B.N.F. coating thickness meter, duplex model. This is the two-coating production model of the instrument shown in last year's exhibition. It is for measuring non-destructively the thicknesses of thin films of metal on different base metals, independently of their magnetic properties. It is primarily intended for electrodeposited films. The thickness is indicated on a 4 in. rectangular meter when a hand- or jig-held probe is applied to the specimen under test, and another electrical contact is made either by a separate clip or through a jig fixture. There is provision for attaching a second probe to the instrument and calibrating its circuit independently of that of the first probe. This will allow the measurement of the thicknesses of dual coatings when the technique has been fully developed by the British Non-Ferrous Metals Research Association.

National Physical Laboratory. Among many instruments displayed is a thermal comparator, a device for rapid comparison of thermal conductivities, and estimation of film thickness and surface finish. The device shown consists of two similar metal balls mounted in insulating material and carrying differentially connected thermocouples. After the unit is heated to a constant temperature excess, it is allowed to rest with one ball in contact with the test surface. The differential e.m.f. observed after 10 sec. is a function of the thermal conductivity of the test material. The condition of the surface affects the readings, so the surface finish of calibrating and test materials should be comparable. Alternatively, the device can measure surface finish. Other possible uses are estimation of film thickness and non-destructive sorting of materials.

Philips Electrical Ltd. This exhibit is being made by the research and control instruments division of the company, and includes X-ray analytical equipment. The X-ray generator, PW.1010, energizes the complete range of Philips' "sealed-off" diffraction tubes, and its optimum individual stabilization of the H.T. and tube current requires no monitoring system. H.T. may be adjusted between 10 and 54 kV, with tube current between 6 and 36 mA in steps of 2 mA. Four shutters covering the X-ray windows may be timed individually from 1 min. to 24 hr. Automatic electrical, cooling water and radiation protection devices are included.

W. G. Pye and Co. Ltd. Included in the instruments to be displayed by this Cambridge company are the following:—automatic titration equipment, an improved system of automatic titration featuring the Pye automatic titrator and the latest Pye *p*H meter/millivoltmeter; a conductance bridge, a mains-operated instrument of high accuracy, designed for general laboratory work, including analytical and quality control determinations. Also a thermocouple test set, a compact instrument which is fully portable, and thermocouple temperature recording equipment.

"Shell" Research Ltd. A special exhibit is being made of a miniature platinum resistance thermometer which has been produced to meet the need for a small temperature-sensing element with an exceedingly high accuracy. It comprises four unsupported helices of 0·001 in. diameter platinum wire, compactly housed in a polytetrafluoroethylene former, 3 mm. diameter by 10 mm. long. The resistance at the ice point is approximately 160 ohms.

Solus-Schall Ltd. Provided by this London company is a display of instruments which includes an ultrasonic flaw detector used for the non-destructive examination of machined parts, forgings, welded joints, and the determination of wall thickness, etc., and employs a frequency pulse echo vibration technique registering on an oscillograph which can be photographically recorded. Also radioactive isotope containers, which consist of a bronze housing filled with lead or tungsten alloy. The former are suitable for a low-energy isotope and the latter for sources of high intensity. There will also be shown industrial X-ray accessories, such as flexible film cassettes, film markers, and the like, while a selection of prototype and newly developed nucleonic equipment includes ratemeters, scalers, power units, radiation monitors, etc.

Thermal Syndicate Ltd. From this Wallsend company comes an interesting display of products. Specimens of "synthetic" fused quartz will be shown in block form for optical purposes, and also as crucibles, etc. This fused quartz is a material of extremely high purity, developed principally for use in the production of semiconductor materials but having, in addition, a greatly increased transmission in the ultra-violet spectrum and resistance to the coloration produced by gamma radiation. The company's standard Vitreosil immersion heaters have been used for many years in chemical solutions, but have not been recommended for use in strong alkalis or hydrofluoric acid. A new type of sheath in aluminous porcelain has been developed for use in alkaline solutions and has proved successful after prolonged testing. A type of sheath suitable for use in hydrofluoric acid is now under development.

United Kingdom Atomic Energy Authority. The various sections of the Authority have combined to make some interesting exhibits. An exhibit from Aldermaston is a demonstration of the deposition of nickel by thermal decomposition of nickel carbonyl. This apparatus is described in the article on page 227.

Industrial News *Home and Overseas*

Bronze and Brass Ingot Makers

On Tuesday last, at the Queen's Hotel, Birmingham, the Twelfth Annual Meeting of the **British Bronze and Brass Ingot Manufacturers' Association** was held under the chairmanship of the President, **Mr. F. Baugh.** After the minutes of the previous meeting had been read and approved, the President presented his report for the past year, in the course of which he said that the Council had met six times since the last A.G.M., and among the problems dealt with were the following:—membership, exports, Clean Air Act, European Free Trade Area, co-operation with other organizations, and explosives in cartridge cases.

With regard to the latter subject, the President said they had taken up the matter with the Ministry, but as yet had received no satisfactory reply. The matter will be pursued energetically, since the Council do not think the responsibility for accidents arising from this type of material should lie with members. They very much regretted that the National Association of Non-Ferrous Scrap Metal Merchants had not supported them in this view.

In his remarks on the subject of exports, the President said that the Government was not willing at the moment to relinquish all control of exports, and the majority of the Association are of the opinion that it is not in the interests of the trade that exports should be decontrolled. At the same time, the control has been eased in a number of ways in the past year by the generous issue of *ad hoc* licences where justified, the removal of limitations on destinations, and the removal of the restrictions which applied to brass only.

Dealing with the operation of the Clean Air Act, the remaining sections of which come into operation on June 1 next, the President referred to the efforts which had been made to have copper works, the definition of which would include ingot manufacturing, scheduled under the Alkali Act. The Minister's proposals as regards copper works were limited to two processes—de-oxygenization by the immersion of wood and the pouring into moulds with an oil dressing. The Council felt that an acurate definition of "copper works" was a very important one, and decided to take counsel's opinion on this. The sections of the industry concerned have held consultations on this, and each has sent a letter to the Ministry strongly urging the enlargement of the definition, in particular to provide for smoke arising from greasy or oily scrap.

The work of the Technical Committee was also specially dealt with in the President's remarks, and he particularly mentioned the way in which the chairman of that committee, Mr. Turner, had carried out his duties. The President ended his report by expressing thanks for the great help he had received from the vice-presidents and the members of the Council during the year.

Discussion on matters arising from the President's report was followed by the report of the Technical Committee, which dealt with such matters as the BS.1400 revision; the sampling and analysis of copper alloys; the effect of impurities on copper alloys; melt quality tests; hard spots in manganese bronze, and ships' side scuttles and frames.

Then followed the annual meeting of the Association, during which the minutes of the previous annual meeting were approved, also the statement of accounts for the year. Election of the Council for the ensuing year resulted in the following gentlemen being appointed:—**Mr. F. Baugh, Mr. T. C. James, Mr. J. H. Barwell, Mr. R. Anderson, Mr. J. N. Cohen, Mr. E. Josephs, Mr. W. E. Laybourne, Mr. G. T. Whitehouse, Mr. R. Wood,** and **Mr. D. A. McGill.**

It was proposed by Mr. J. N. Cohen and seconded by Mr. G. T. Whitehouse that **Mr. F. Baugh** be re-elected as President, and this motion was carried unanimously. **Mr. J. H. Barwell** and **Mr. T. C. James** were re-elected as vice-presidents. After a vote of thanks to the chairman of the meeting had been proposed, the proceedings terminated.

Portable Lighting Kit

A new harness has been produced by **Nife Batteries Ltd**, which enables their hydrogen and pentane intrinsically safe cap lamps to be used also as chest lamps. These lamps are fully approved by the Inspector of Factories for use in dangerous atmospheres containing hydrogen and pentane fumes, and are particularly suitable for use in aircraft refuelling operations, in refiners, chemical works, and petroleum and oil storage plants.

New Crompton Premises

In order to facilitate efficient stores distribution in the London area, **Crompton Parkinson Ltd.** are opening an additional stores and trade counter for batteries, cables, lamps, light fittings and small motors at College Gardens, Edmonton, London, N.18, with the telephone number Edmonton 7141.

These stores will serve all N., N.E., E., and N.W. postal areas, and also postal areas W.C.1 and E.C.1, the county of Essex, and North and North-West Middlesex.

A Ventilation Contract

It is announced by **Colt Ventilation Ltd.** that they have secured the contract for the ventilation of the Hall of Technology of the British Government Pavilion at the Brussels Exhibition. The scheme of ventilation had to allow for the fact that, in accordance with modern display technique, the building is lighted entirely artificially, causing a considerable extra heat load, and that there are, therefore, no windows. Considerable heat gain during peak public hours through human occupancy, and heat caused by solar radiation on fine summer days, has also been taken into account, and the scheme has been made as visually unobtrusive as possible.

These requirements were achieved by using 12 low-silhouette Colt S.R. extract ventilators in the wide-spanned flat roof fed through grilles designed in the two suspended ceilings below. Replacement inlet air is by built-in vents at low level.

The Film Section of the Hall had its own special problems by reason of the 22 cameras and other electrical equipment which had to be kept cool, and this has been arranged by three fan-operated Colt roof inflow units, which deliver pencils of cool, fresh air on to the electrical apparatus involved. Each of these inflow units is fitted with a special variable air projector, which can be manually adjusted at will to feed cooling air streams in any direction or variety of directions at the same time. The hot vitiated air from the film section is again extracted by Colt high-duty roof extracts.

Nickel Cuts

It is reported that the International Nickel Company is curtailing production of nickel in Canada by approximately ten per cent or about two-and-a-half million lb. a month. The present rate of nickel production by the company and by other nickel producers is substantially in excess of total market demand as well as consumption, the company says. Furthermore, stocks of unsold nickel in the hands of the company and in the hands of the U.S. Government as a result of the industry's inability to take nickel offered to the trade instead of being stockpiled, are accumulating at a rapid rate and will soon total approximately one hundred million lb. These accumulations do not include nickel in the U.S. Government stockpile or unconsumed nickel in the inventories of customers. Also, in view of excessive current accumulations by the U.S. Government, deliveries of nickel by the company to the U.S. stockpile previously scheduled for 1958 have been re-scheduled for 1959.

"Under all these circumstances, a ten per cent cut-back in our production is the minimum required at the present time," the company says. "The large stocks of nickel available to industry in the hands of both the company and the U.S. Government are expected to continue to climb. Unless business in Canada and the U.S. shows a quick upturn, a further cut-back in our production may, therefore, become necessary," it adds.

Aluminium on the Racecourse

At any racecourse a conspicuous running rail that clearly indicates the course for the benefit of both jockeys and spectators is very desirable. This year, visitors to Newbury will see on the far side of the course, opposite the grandstand, trial lengths of a new type of rail constructed of unpainted aluminium alloy.

Normally rails are made of wood and, to maintain their appearance and to preserve them, they need to be continually repainted, generally once a season. With several miles of railing to be painted every time, this can be a very expensive and time-consuming procedure. The object of the installation of these aluminium rails is to confirm that, although the brightness of the material will tone down in time, it will still not require painting. The consequent savings in maintenance costs, together with the metal's advantages of strength and appearance, will make the replacement, when necessary, of wooden rails by aluminium ones, an attractive proposition. By designing to suit the material, a neat rail section has been produced that has no bolts or fastenings that can possibly protrude. Designed by **Northern Aluminium Company Ltd.**, in conjunction

with the Jockey Club of Great Britain, the rail has a broad flat surface on the racing side, and an integral lipped-channel at the back that serves the dual purpose of strengthening the rail and acting as a holding groove for the fastening bolts.

Installed in the autumn of last year, these rails are very conspicuous from the grandstand and their natural "whiteness," combined with good appearance, simplicity of fixing, and strength, suggest that they will prove a "winner" with course-owners, spectators and jockeys alike.

Showing at Brussels

Their non-metallic electric furnace element is being shown at the Brussels Exhibition by **The Morgan Crucible Company Ltd.,** which states that the great advantage of this form of heating—simplicity of furnace design, cleanliness and absence of flue gases—can now be used in all temperature ranges up to 1,500°C. Furnaces covering the higher temperatures in this range, e.g. glass, porcelain, drop-stamping and forging, can only meet the temperature and atmospheric requirements effectively by the use of silicon carbide elements.

This non-metallic element—Crusilite—is a one-piece, exceptionally strong silicon carbide tube, produced by a new method which uses a spiral as the hot zone. There are no joints between hot and cold zones. This element is manufactured in a large range of sizes and resistance values to cover the electrical conditions most frequently met in common practice.

These elements, and two demonstration furnaces showing Crusilite in action, may be seen at the World Fair in Brussels, on the Birmingham Exchange and Engineering Centre Stand, Block "C," British Industries Pavilion.

E.G.G.D. Office Moves

Both the London and Nottingham offices of the Export Credits Guarantee Department are now at new addresses. The London office is at Marlon House, Mark Lane, London, E.C.3, under the managership of Mr. A. L. MacManus, M.B.E., and this office covers the London postal districts and the counties of Norfolk, Suffolk, Cambridge, Hertford, Bedford, Huntingdon, Essex, and Kent.

The Nottingham office is situated at Lloyds Bank Chambers, Old Market Square, Nottingham, and is under the managership of Mr. T. H. Collinson. The counties covered are Nottingham, Derby, Leicester, Lincoln, Rutland, and Northampton.

Telex Installation

We are informed by **Metal Sales Company Ltd.,** of Temple Street, Birmingham, that they have now installed Telex, their number being 33393, with the "answer-back" code—Kennecort Birmingham.

Expansion in Canada

Plans were recently announced in Toronto of the steps being taken by Electric Reduction Company of Canada Ltd. to implement the company's overall, long range plans of expansion and diversification in the fast-growing Canadian chemical industry.

These plans follow talks held in London with the parent company, **Albright and Wilson Ltd.** It is stated that expansion of sodium chlorate facilities in Eastern Canada will consist in more than doubling the capacity of the company's plant at Buckingham, Quebec. At the same time, the company's operations in North Vancouver are being expanded by 50 per cent.

International Meeting

Several hundred industrial leaders, engineers, scientists and other specialists from 40 countries are to meet in Harrogate this coming June for the 1958 assembly of the **International Organization for Standardization.** This will be the first occasion on which the I.S.O. assembly has been held in this country. The meetings of the full assembly of the I.S.O. Council, and of 15 specialized technical committees, will be opened on June 9 by the President, Sir Roger Duncalfe, and they will continue until June 21. Arrangements are in the hands of the British Standards Institution.

Metal Finishing

On Friday of next week, March 28, the Sheffield and North-East branch of the **Institute of Metal Finishing** will hold a meeting at the Grand Hotel, Sheffield, at 7 p.m., when a Paper will be presented by Mr. K. E. Langford on "Analytical Control of Plating Solutions."

Isotope Courses

A course on radioisotopes designed to give senior executives in industry an appreciation of the possible applications of those materials will be held at the **Harwell Isotope School** from September 23 to 26. Two similar courses have been arranged in April (15-18) and July (8-11) for members of the Institute of Directors only.

The course consists of lectures on the elementary principles of work with radioactive isotopes, with the emphasis strongly towards their application as tools in industry and research. The lectures will be given in as non-technical a manner as possible by scientists experienced in the field: they will be supplemented by visits to a reactor and to the laboratories of the Isotope Division at Harwell and to the Wantage Radiation Laboratory near Harwell. The lectures and demonstrations will be given in the Cockcroft Hall at Harwell.

Over the period of the conference delegates will stay in an Oxford college: transport from Harwell to Oxford and back each day will be arranged. The fee for the course, including accommodation, meals, transport and lectures, is £40, payable in advance. Applications for places will be accepted strictly in rotation: application forms are obtainable from The Registrar, Isotope School, Atomic Energy Research Establishment, Harwell.

New Barrier Creams

Two new creams, Nos. 13 and 16, have been added to the range of barrier creams for industrial and domestic use produced by **Rozalex Ltd.** Cream No. 13 was originally formulated for special purposes for the United Kingdom Atomic Energy Authority. Its prime function was to make it easier for protective clothing to be decontaminated. However, it was also found to be a most effective barrier cream for office workers using duplicating inks and carbons.

This new cream, applied to the hands before work, makes it easy for the inks to be washed off in warm running water, and it is unnecessary to use abrasives, solvents or bleaches. The excellent water-repellency of silicones is a major quality of Rozalex No. 15, which is neither greasy nor sticky. This cream has a low surface tension and good adherence to the skin, and is especially suitable for personnel engaged in surgical, clinical and laboratory work, processing synthetic fibres, photography, bottling plants and many other similar fields.

Gauge and Tool Makers

Plans are now well advanced for the 1958 Gauge and Tool Exhibition, organized by the **Gauge and Tool Makers' Association,** which is to be held at Olympia, London, from Monday, May 12, to Wednesday, May 21 inclusive. Both the ground floor and balcony of the National Hall will be fully occupied by the 126 exhibitors, who will be showing a wide range of their products. There will be a number of machine tools on stands demonstrating the uses of small tools and gauges, and also some 20-30 power presses in action.

The exhibition will be open daily from 10 a.m. to 6 p.m., and the admission charge will be 2s. 6d. The Association is holding a dinner-dance in conjunction with the exhibition, and this will take place at the Dorchester Hotel, Park Lane, London, on Wednesday, May 14.

It is also announced that the Golfing Society of the Association will hold its first meeting of the year at the Little Aston Golf Club, Streetly, Sutton Coldfield, Warwickshire, on Wednesday, April 23 next.

News from Birmingham

Quieter conditions have developed in some branches of industry in the Midlands, and this accounts for the slightly increased rate of unemployment as shown by the latest figures. The percentage rate is 1·3, compared with a national figure of 1·9, and the number of unemployed has risen in a month from 25,179 to 27,995. This was spread over various industries, including building, metals, vehicles and engineering. Although most of the motor car factories are well situated for work, one firm has just started a four-day week, due, it is stated, to a slight falling-off in orders for North America. The building trade is certainly slacker than it has been for a long time, and this is having an adverse effect on demand for raw materials in the form of castings and pressings.

In the steel trade, demand for heavy plates and sheets is still in excess of supply. Otherwise there is a better balance between supply and demand, and reasonable deliveries can be given of most products. The engineering industries are taking considerable tonnages of castings. Trade in light castings, however, is still very quiet. Sheets are being delivered in substantial quantities to the motor trade. Re-rollers are unable to work mills to full capacity owing to a shortage of orders. There is no shortage of pig iron, whether for foundry purposes or for the production of steel.

News from Scotland

There is growing evidence of quieter conditions in the Scottish metalworking areas, with a fair number of short-time programmes introduced and in some cases dismissal of labour. Allied Ironfounders have reduced activity at their Castlelaurie works at Falkirk because of quieter demand in the export markets. Allied to the slower volume of overseas business is the question of costs, which have tended

to rise here to a point which is affecting overseas business.

In Govan, Harland and Wolff have indicated that some 100 workers—moulders, cranemen, slingers and labourers—will become redundant. No details are available of this contraction of work, which is regarded as serious by the workers' union. The picture which is emerging in Scotland is that small pockets of idle time and reduced working have emerged over the country. The overall picture is not regarded as being really serious so far, but it could well become so if present developments continue. Earlier in the week, Stewarts and Lloyds had indicated reduced working at Tollcross and Mossend, because of quieter demand abroad. Export markets have been generally quiet, with a consequent possibility of short-time working in this section of the industry.

Electrical Engineers Exhibition

ON Tuesday next, March 25, the Electrical Engineers Exhibition will open at Earls Court, London, and remain open until Saturday, March 29. The opening ceremony will be performed at 12 noon on Tuesday next by the President of the Board of Trade. A wide range of electrical products is being shown and below we are able to give some brief notices of a few of the exhibits.

On Stand G.9, a comprehensive selection of their wide range of products is made by **British Insulated Callender's Cables Ltd.** These include cabled copper tube for instrumentation and control purposes; atomic grab cables insulated with P.T.F.E., for reactor charging machinery; mineral insulated cables and accessories; copper and aluminium busbars, strands and sections, as well as various other types of cables and accessories.

Electroplating and polishing processes for the decorative and protective finishing of metals are featured on the stand of **W. Canning and Co. Ltd.** In order to illustrate this, there will be a large display of specimen articles drawn from a cross-section of the electrical industry. These will include components for industrial and domestic purposes, and will show practical applications of the following finishes: "Cuprax" high efficiency cyanide copper No. 2989; "Cuprobrite" bright copper plating process No. 2774 (articles plated in this process may be bright nickel plated direct without intermediate buffing; bright nickel B.Q.840, an entirely new solution for decorative and protective purposes which is suitable for both still vat and automatic plating; "Zinax" bright chrome salts No. 968F; "Silvax" high-speed bright silver salts No. 3007; "Kadamax" high-speed bright cadmium salts No. 2876; "Super Zyntax" high-speed bright zinc No. 2903; and bronze finishing. In addition to plated finishes, special attention has been given to the materials and methods for polishing plastics of various types. This branch of industrial finishing will be represented by articles showing specimen finishes.

All who seek information or advice on the use of copper or copper alloys in any of the branches of electrical or electronic engineering are invited to visit the stand (T.5) of the **Copper Development Association.** Exhibits will include components manufactured from cadmium copper, chromium copper, silver copper and tellurium copper, while other items shown comprise cables, radio valves and printed circuits. Of particular interest on this stand will be a sectioned scale model, a 23,500 kVA English Electric turbine generator as installed in the Invergarry hydro-electric power station, and which convincingly demonstrates the many applications of copper in an undertaking of this nature.

A Heenatone programme control unit, designed for a repeated cycle of operations, will be among the equipment shown by **Heenan and Froude Ltd.** on Stand T.2. A further feature of this stand will be a selection from the standard range of air-cooled slip couplings which cover duties up to approximately 100 h.p. for constant torque drives, and higher for fan and similar drives. A number of electronic control units will also be shown. These provide D.C. excitation for the couplings from normal A.C. mains and make use of low power components even for the largest Heenan-Dynamatic coupling. A working demonstration unit will be on view.

A range of hand-operated and hydraulic machines to bend from ½ in. to 2 in. electrical conduit is being exhibited and demonstrated by **Hilmor Ltd.** All these machines are portable, and require no fixing or bolting down. A machine to be shown for the first time is model R.P.5, which is mounted on a portable stand and has a capacity up to 1½ in. screwing conduit. It is operated through a powerful ratchet and screw, and will produce all bends required for normal installation purposes speedily, accurately, and with the minimum of manual effort.

On Stand V.4, **Honeywell Brown Ltd.** will display a wide range of modern micro switches, including production models of prototypes shown last year, as well as representative selections from the company's familiar range. Shown with the switches will be many actuators, permitting both automatic and manual operation. Industrial enclosed switches, now in production, have been designed to remain completely reliable while subject to high temperatures, oil, dirt, and moisture. A selection of thermostatic controls will also be shown, including a line voltage room thermostat and the "Honeywell Round," a low voltage room thermostat.

Making its debut on the stand of **Newman Industries Ltd.** (M.2), will be the "Thoroughbred" single-phase motor which, as its name implies, has been designed exclusively for single-phase duty. The Newman stand will, in effect, tell the story of the company's great post-war development programme, with the new single-phase as the highlight for this current year. Various examples of the company's activities over the years will be shown.

A prominent feature of the stand of **Panelec (Great Britain) Ltd.** (T.18) will be a model showing a general arrangement of the floor warming system, which will clearly demonstrate the cable housing sections, embedded in the floor screed, and the spring clips which attach the metal heat diffuser to them. Also shown will be photographs showing installations in progress and completed, and layout drawings illustrating details of electric floor warming as installed in typical buildings.

Products representative of practically the entire range of their lamps and lighting equipment—including several new additions—are being shown by **Philips Electrical Ltd.** on Stand K.14. Other items of interest to electrical engineers, and which are marketed by the company's research and control instruments division, will also be exhibited.

A full range of their products will be shown on Stand T.23 by **Suffolk Iron Foundry (1920) Ltd.** Special interest will be attached to the demonstration of the use of Sifbronze rings with "Stanelco" automatic flame brazing equipment. Also to be seen will be the new "Demon" cutting blowpipe, which has a cutting range of 10 in.

On the stand (H.2) of **Henry Wiggin and Company Ltd.** will be demonstrated the many uses of the Brightray series of nickel-chromium electrical resistance materials in domestic and industrial heating equipment, and also of the nickel-copper alloy Ferry in load regulator resistances for diesel-electric traction.

Parliamentary News

By Our Lobby Correspondent

Mrs. Joyce Butler (Lab., Wood Green) asked the Minister of Health, as representing the Lord President of the Council, in the Commons, what estimate he had made of the incidence of nickel dermatitis; and what investigation had been made as to the cause and prevention of that complaint.

The Minister of Health, Mr. D. Walker-Smith, replied that the incidence of nickel dermatitis had not been exactly assessed, but it seemed to be a fairly common form of dermatitis, particularly among women. People who were sensitive to the metal might develop dermatitis after contact with some nickel-plated item of apparel. It could only be prevented by avoiding contact with nickel.

Mrs. Butler: "Could the Minister look at the possibility of discussing this with the manufacturers of zip fasteners and costume jewellery, which trigger off these attacks of dermatitis, to see whether it is not possible to do more in the way of covering the metal with enamel, or providing a substitute in the form of plastics, since this is a very widespread complaint among women and seems to be growing?"

Mr. Walker-Smith: "I will certainly consider what Mrs. Butler has said to see whether there is any advice which it is both possible and appropriate for Ministers to give in this context."

Forthcoming Meetings

March 26—Institute of British Foundrymen. London Branch. Constitutional Club, Northumberland Avenue, London, W.C.2. "Patternmaking Progress." B. Levy. 7.30 p.m.

March 26 — Manchester Metallurgical Society. Manchester Room, The Central Library, Manchester. "Some Metallurgical Aspects of Nuclear Power Development." H. K. Hardy. 6.30 p.m.

March 28—Institute of Metal Finishing. Sheffield and North-East Branch. Grand Hotel, Fitzwilliam Room, Sheffield. "Analytical Control of Plating Solutions." K. E. Langford. 7 p.m.

Metal Market News

THE principal feature in the non-ferrous situation last week was the sustained activity of the American commodity exchange, where many hundreds of lots of copper changed hands at advancing prices. According to report, this burst of buying came from speculators who were persuaded to buy what is regarded as a cheap commodity by way of a hedge against inflation. On Wall Street, copper mining shares were firm and staged worthwhile increases, but on our stock exchange the movements in coppers were erratic. Not unnaturally, the standard copper market was affected by the much improved tone in the United States, and there was a gain on the week of £5 for cash and £4 10s. 0d. for three months, the respective positions being quoted at £168 10s. 0d. and £170. The turnover was 8,075 tons. At the beginning of the week stocks in L.M.E. warehouses were reported 85 tons lower at 19,972 tons. What may well have started off the speculative buying on the New York commodity exchange, and was certainly responsible initially for a firmer tone in Whittington Avenue, was the announcement that Kennecott was reducing its U.S. operations from six to five days per week. This is understood to represent a cut of 12½ per cent in output, and has been adopted as a measure to bring supply in line with demand. One way and another, the copper situation is gradually getting straightened out, and there is always the chance that we shall see in the near future the beginning of an upward movement in London.

It is generally agreed that although consumption of copper in the United States is distinctly off, the same cannot be said of Europe where, one way and another, usage of the metal has kept going very well indeed. Recent reports suggest that perhaps Germany is not so busy now as a few months ago, but broadly speaking the situation is not too bad. Here, in the United Kingdom, the Bureau figures show that although activity may be somewhat below the best period of last year, consumption of copper is, nevertheless, satisfactory. However, users are inclined to stick to hand-to-mouth buying, apparently on the assumption that a lower price is coming later on, maybe in the summer months when consumption normally declines. However, it seems that in the States there is a change of heart, but whether the recession has really spent itself is by no means clear. As already stated, the Commodity Exchange was active in copper trading, and this continued right through the week with rising prices, but on Friday, coinciding with heaviness on Wall Street, the copper futures market looked rather unsure of itself, and the progress made in value was negligible. More Continental enquiry and some improvement in the volume of the tonnage placed was reported on Friday.

Tin looked a little unsure of itself last week, and closed £3 down for cash and £4 lower for three months at £732 and £738 for the respective positions. Trading was rather slow and the turnover amounted to 1,035 tons, of which probably none was purchased by the Pool. It is believed that better business is passing with the United States, but reports from that quarter are rather mixed and it is not easy to obtain a clear picture of the situation across the Atlantic. However, the opinion is gaining ground that tin is due for a further advance during the coming weeks. Both lead and zinc were fully steady but rather uninteresting, as there was no special feature in either of these metals apart from a rumour that the long-delayed decision about the revision of the American import duties would be reached during this month. Trading was reasonably active, for some 6,000 tons of lead changed hands on the market, with the close at £75 for March and £74 15s. 0d. for June. Values improved by 5s. and 15s. for the respective positions. In zinc, the turnover was 6,050, March closing 7s. 6d. up at £63 15s. 0d. and June 10s. better at £64.

New York

The big news in copper for last week was the announcement by Kennecott Copper Corporation that it was cutting its U.S. copper output by another 12½ per cent. There was some speculation in the trade about how much the cut-back would mean in actual tonnage, but estimates ranged from 6,200 to 7,300 tons monthly, including the 3,800 ton cut-back which came into effect in January. The company said the present cut-back, together with previous reductions, would result in a production curtailment of 20½ per cent from former capacity operations.

One leading copper source said that Kennecott's cut in production should have a beneficial effect on the market and, if followed by other larger foreign producers, would hasten the corrective to the present over-supply situation which has been the principal cause for price weakness.

Brass and wire mills reported no improvement in demand for their products from the low rates prevailing in past months. A wire and cable manufacturer said buying of wire and cable for shipment in April—historically the best month of the year—was a little better than it had been for the past few months, but was still considerably below buying for this period in recent years.

Lead and zinc sales were spotty, trade sources said. Lead was somewhat better than in recent weeks, but sales still left much to be desired. Zinc volume was helped by improved buying from steel galvanizers. Both lead and zinc sold mostly on an average price basis.

Tin was firmer on strength in Singapore, reflecting indications of growing tightness of offerings because of the export quota.

Toronto

Despite a distinct falling-off in the final half of the year, the volume of export shipments of five of Canada's leading base metals (aluminium, copper, lead, nickel and zinc) still managed to show a slight gain for the full year of 1957. The total was 2,842,017,300 lb., some 13,381,400 lb., or 0·5 per cent, ahead of the 1956 total of 2,828,635,900 lb. The value of exports dropped, due to lower prices for copper, lead and zinc, by $23,153,896, or 3·6 per cent, to $708,581,608, compared with a value of $731,734,504 in 1956.

The sharp change in the trend that occurred in the latter part of 1957 can be seen from the fact that for the first half of 1957 the volume of export shipments showed an increase of 185,493,400 lb., or 15 per cent, at 1,424,542,000 lb., and their value increased $37,557,374, or 11·2 per cent, over the like period of 1956 at $373,058,798. In the second half, the volume of metals exported, at 1,417,475,300 lb., was down 172,112,000, or 10·8 per cent, from the final six months of 1956, and the value of metals shipped showed a decline of $60,710,270, or 15·3 per cent, at $335,522,810.

Of the five metals, the best showing for 1957 was made by nickel, with the volume of exports up 3,609,900 lb., or 1 per cent, at 357,315,400 lb., and the value increasing $25,344,256, or 11·4 per cent at $248,253,042.

While the volume of copper exports recorded a sizeable gain, one of 59,008,300 lb., or 13·7 per cent, at 490,684,100 lb., the sharply lower price for the metal was reflected in a reduction in the value of exports of $23,753,367, or 13·7 per cent, at $149,143,096.

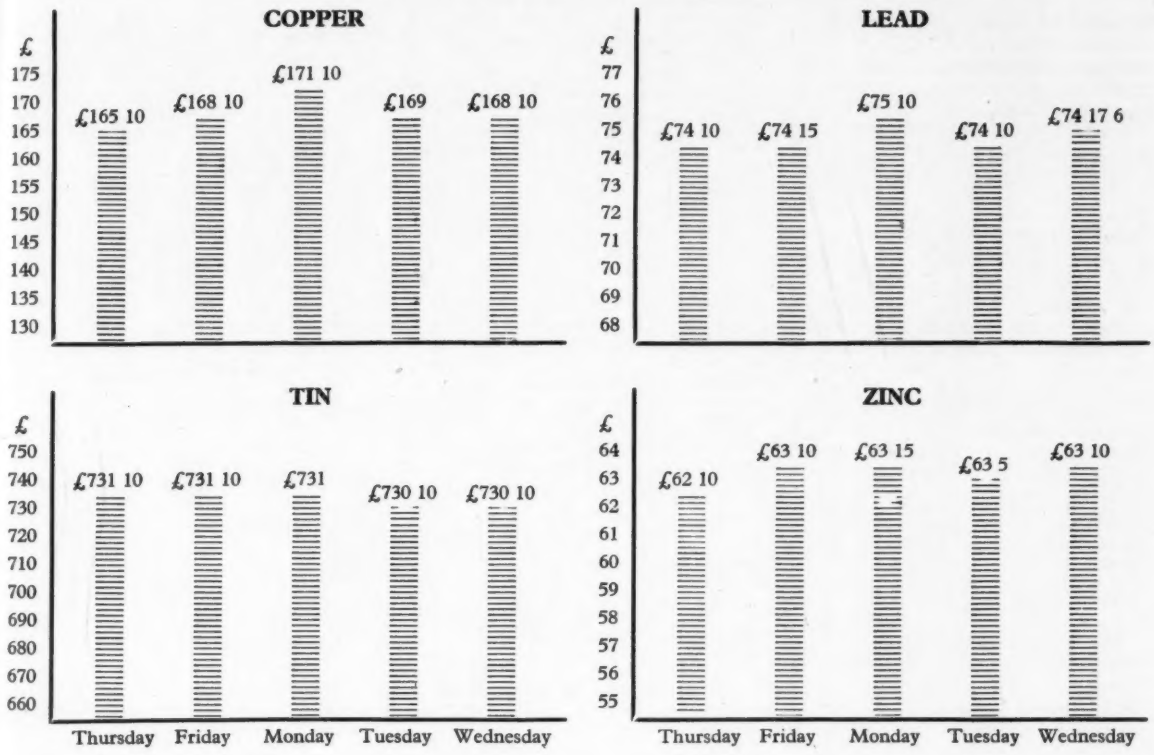
Volume of zinc exports increased 12,213,100 lb., or 1·6 per cent, at 778,295,800 lb., but their value was down $9,226,597, or 12·6 per cent, at $64,271,216.

The volume of aluminium exports fell by 60,646,300 lb., or 6 per cent, at 957,340,900 lb., and the value of shipments was down $10,003,172, or 4·4 per cent, at $217,428,514.

Lead exports were off 833,600 lb., or 0·3 per cent to 258,381,100 lb. in volume and the value shrank $5,514,016, or 15·8 per cent, at $29,485,740.

METAL PRICE CHANGES

LONDON METAL EXCHANGE, Thursday 13 March 1958 to Wednesday 19 March 1958



OVERSEAS PRICES

Latest avaliable quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏ £/ton	Canada c/lb ≏ £/ton	France fr/kg ≏ £/ton	Italy lire/kg ≏ £/ton	Switzerland fr/kg ≏ £/ton	United States c/lb ≏ £/ton
Aluminium		24.63 203 10	210 182 15	400 232 0	2.50 209 0	28.10 224 17 6
Antimony 99.0			195 169 12 6	430 249 10		29.00 232 0
Cadmium			1,400 1,218 0	2,550 1,479 0		155.00 1,240 0
Copper						
Crude						
Wire bars 99.9				340 197 5		
Electrolytic	23.25 170 0	24.50 202 7 6	216 188 0		2.10 175 12 6	25.00 200 0
Lead		12.25 101 2 6	123 107 0	182 105 10	.95 79 10	13.00 104 0
Magnesium						
Nickel		71.50 590 10	1,205 104 17 6	1,330 771 10	7.80 652 5	74.00 592 0
Tin	103.00 753 0		902 784 15	1,430 829 10	8.70 727 10	95.25 762 0
Zinc						
Prime western		10.00 82 12 6				10.00 80 0
High grade 99.95		10.60 87 10 0				
High grade 99.99		11.00 90 5				
Thermic			107.12 93 2 6			
Electrolytic			115.12 100 2 6	157 91 0	.82 68 10	11.75 94 0

NON-FERROUS METAL PRICES

(All prices quoted are those available at 12 noon 19/3/58)

PRIMARY METALS

		£	s.	d.
Aluminium Ingots	ton	197	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		10	0
Calcium	„	2	0	0
Cerium 99%	„	13	18	0
Chromium	„		6	11
Cobalt	„		16	0
Columbite	per unit		—	
Copper H.C. Electro	ton	168	10	0
Fire Refined 99·70%	„	167	0	0
Fire Refined 99·50%	„	166	0	0
Copper Sulphate	„	64	0	0
Germanium	grm.		—	
Gold	oz.	12	9	2½
Indium	„		10	0
Iridium	„	27	0	0
Lanthanum	grm.		15	0
Lead English	ton	74	17	6
Magnesium Ingots	lb.		2	5½
Notched Bar	„		2	10½
Powder Grade 4	„		6	3
Alloy Ingot, A8 or AZ91	„		2	8
Manganese Metal	ton	300	0	0
Mercury	flask	77	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	
Palladium	„	7	10	0
Platinum	„	26	15	0
Rhodium	„	40	0	0
Ruthenium	„	16	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	4½
Tellurium	lb.		15	0
Tin	ton	730	10	0
Titanium	lb.		19	6
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	63	10	0
Dust 95/97%	„	104	0	0
Dust 98/99%	„	110	0	0
Granulated 99+%	„	88	10	0
Granulated 99·99+%	„	101	8	9

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

Aluminium Alloy (Virgin)		£	s.	d.
B.S. 1490 L.M.5	ton	227	0	0
B.S. 1490 L.M.6	„	217	0	0
B.S. 1490 L.M.7	„	231	0	0
B.S. 1490 L.M.8	„	220	0	0
B.S. 1490 L.M.9	„	218	0	0
B.S. 1490 L.M.10	„	236	0	0
B.S. 1490 L.M.11	„	231	0	0
B.S. 1490 L.M.12	„	240	0	0
B.S. 1490 L.M.13	„	231	0	0
B.S. 1490 L.M.14	„	241	0	0
B.S. 1490 L.M.15	„	227	0	0
B.S. 1490 L.M.16	„	222	0	0
B.S. 1490 L.M.18	„	220	0	0
B.S. 1490 L.M.22	„	228	0	0

		£	s.	d.
†**Aluminium Alloy (Secondary)**				
B.S. 1490 L.M.1	ton	155	0	0
B.S. 1490 L.M.2	„	161	0	0
B.S. 1490 L.M.4	„	183	0	0
B.S. 1490 L.M.6	„	205	0	0
†Average selling prices for January				
***Aluminium Bronze**				
BSS 1400 AB.1	ton	198	0	0
BSS 1400 AB.2	„	216	0	0
***Brass**				
BSS 1400-B3 65/35	„	125	0	0
BSS 249	„		—	
BSS 1400-B6 85/15	„		—	
***Gunmetal**				
R.C.H. 3/4% ton	ton		—	
(85/5/5/5)	„	150	0	0
(86/7/5/2)	„	159	0	0
(88/10/2/1)	„		—	
(88/10/2/½)	„	216	0	0
Manganese Bronze				
BSS 1400 HTB1	„	162	0	0
BSS 1400 HTB2	„	180	0	0
BSS 1400 HTB3	„		—	
Nickel Silver				
Casting Quality 12%	„		nom.	
„ „ 16%	„		nom.	
„ „ 18%	„		nom.	
***Phosphor Bronze**				
2B8 guaranteed A.I.D. released	„	235	0	0
Phosphor Copper				
10%	„	202	0	0
15%	„	211	0	0
**Average prices for the last week-end.*				
Phosphor Tin				
5%	ton		—	
Silicon Bronze				
BSS 1400-SB1	„		—	
Solder, soft, BSS 219				
Grade C Tinmans	„	346	9	0
Grade D Plumbers	„	281	3	0
Grade M	„	379	6	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.		—	
Type 9	„		—	
Zinc Alloys				
Mazak III	ton	94	13	9
Mazak V	„	98	13	9
Kayem	„	104	13	9
Kayem II	„	110	13	9
Sodium-Zinc	lb.		2	5

SEMI-FABRICATED PRODUCTS

Prices of all semi-fabricated products vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			£	s.	d.
Sheet 10	S.W.G.	lb.		2	9
Sheet 18	S.W.G.	„		2	11
Sheet 24	S.W.G.	„		3	2
Strip 10	S.W.G.	„		2	9
Strip 18	S.W.G.	„		2	10
Strip 24	S.W.G.	„		2	11½
Circles 22	S.W.G.	„		3	3
Circles 18	S.W.G.	„		3	2
Circles 12	S.W.G.	„		3	1
Plate as rolled		„		2	8½
Sections		„		3	2½
Wire 10	S.W.G.	„		3	0
Tubes 1 in. o.d. 16 S.W.G.		„		4	1

Aluminium Alloys			£	s.	d.
BS1470. HS10W.		lb.			
Sheet 10	S.W.G.	„		3	1½
Sheet 18	S.W.G.	„		3	4
Sheet 24	S.W.G.	„		3	11½
Strip 10	S.W.G.	„		3	1½
Strip 18	S.W.G.	„		3	3
Strip 24	S.W.G.	„		3	11
BS1477 HP30M. Plate as rolled				2	11½
BS1470. HC15WP.					
Sheet 10	S.W.G.	lb.		3	9½
Sheet 18	S.W.G.	„		4	1½
Sheet 24	S.W.G.	„		4	11½
Strip 10	S.W.G.	„		3	10½
Strip 18	S.W.G.	„		4	1½
Strip 24	S.W.G.	„		4	9
BS1477. HPC15WP. Plate heat treated		„		3	6½
BS1475. HG10W. Wire 10	S.W.G.	„		3	10½
BS1471. HT10WP Tubes 1 in. o.d. 16 S.W.G.		„		5	0
BS1476. HE10WP. Sections		„		3	2
Beryllium Copper					
Strip		„	1	4	11
Rod		„	1	1	6
Wire		„	1	4	9
Brass Tubes		„		1	5
Brazed Tubes		„		—	
Drawn Strip Sections		„		—	
Sheet		ton		—	
Strip		„	199	15	0
Extruded Bar		lb.		1	8½
Extruded Bar (Pure Metal Basis)		„		—	
Condenser Plate (Yellow Metal)		ton	140	0	0
Condenser Plate (Naval Brass)		„	151	0	0
Wire		lb.		2	2½
Bronze Sheet and Strip		ton		—	
Copper Tubes		lb.		1	8½
Sheet		ton	200	5	0
Strip		„	200	5	0
Plain Plates		„		—	
Locomotive Rods		„		—	
H.C. Wire[1]		„	216	15	0
Cupro Nickel Tubes 70/30		lb.		3	1½
Lead Pipes (London)		ton	115	5	0
Sheets (London)		„	113	0	0
Tellurium Lead		„	£6 extra		
Nickel Silver Rods		lb.		—	
Sheet and Strip 7%		„		3	2
Wire 10%		„		3	8½
Phosphor Bronze Wire		„		3	5½
Titanium					
Billet		lb.	4	10	0
Sheet		„	6	12	0
Wire		„	9	10	0
Tube		„	16	0	0
Zinc Sheets, English destinations		ton	98	0	0
Strip		„	nom.		

Financial News

Metal Statistics

Detailed figures of the consumption and output of non-ferrous metals for the month of Jan., 1958, have been issued by the British Bureau of Non-Ferrous Metal Statistics, as follow in long tons:—

COPPER	Gross Weight	Copper Content
Wire	24,151	23,736
Rods, bars and sections	12,764	8,468
Sheet, strips and plate	13,565	10,784
Tubes	7,758	7,086
Castings and miscellaneous	7,049	—
Sulphate	3,088	—
	68,375	56,615
Of which:		
Consumption of Virgin Copper		46,437
Consumption of Copper and Alloy Scrap (Copper Content)		10,178

ZINC	
Galvanizing	7,980
Brass	8,794
Rolled Zinc	2,093
Zinc Oxide	2,537
Zinc Die-casting alloy	4,247
Zinc Dust	840
Miscellaneous Uses	982
Total, All Trades	27,473
Of which:	
High purity 99·99 per cent	4,753
Electrolytic and high grade 99·95 per cent	5,471
Prime Western, G.O.B. and debased	10,122
Remelted	436
Scrap Brass and other Cu alloys	3,468
Scrap Zinc, alloys and residues	2,873

ANTIMONY	
Batteries	82
Other Antimonial Lead	45
Bearings	31
Oxides—for White Pigments	153
Oxides—other	100
Miscellaneous Uses	17
Sulphides	7
Total Consumption	435
Antimony in Scrap	
For Antimonial Lead	409
For Other Uses	28
Total Consumption	437

LEAD	
Cables	9,655
Batteries	2,488
Battery Oxides	2,514
Tetra Ethyl Lead	1,664
Other Oxides and Compounds	1,729
White Lead	778
Shot	411
Sheet and Pipe	5,727
Foil and Collapsible Tubes	405
Other Rolled and Extruded	506
Solder	1,144
Alloys	1,461
Miscellaneous Uses	1,125
Total	29,607

CADMIUM	
Plating Anodes	43·80
Plating Salts	6·60
Alloys: Cadmium Copper	3·50
Alloys: Other	2·70
Batteries: Alkaline	9·30
Batteries: Dry	0·30
Solder	1·80
Colours	20·80
Miscellaneous Uses	2·45
Total Consumption	91·25

TIN	
Tinplate	804
Tinning:	
Copper Wire	47
Steel Wire	8
All other	66
Solder	148
Alloys	510
Foil and Collapsible Tubes, etc.	61
Tin Compounds and Salts	81
Miscellaneous Uses	9
Total Consumption	1,734

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons, Limited, Company Registration Agents, Chancery Lane, W.C.2.

R. Loades Limited (597932), Ivy Pit, off Beccles Road, Oulton Broad, Lowestoft. Registered January 27, 1958. To carry on business of scrap metal merchants, machinery merchants, etc. Nominal capital, £100 in £1 shares. Directors: R. C. Loades and Doreen E. Loades.

Metallic Industrial Components Ltd. (598173), 18 Southampton Place, W.C.1. Registered January 31, 1958. To carry on business of engineering component manufacturers, etc. Nominal capital, £10,000 in £1 shares. Directors: Thos. F. Watson, Robert H. Hargreaves and William J. Dixon.

West Country Aluminium and Zinc Refining Company Limited (598215), 14 High Street, Midsomer Norton, nr. Bath. Registered January 31, 1958. To take over business carried on at Radstock by West Country Aluminium and Zinc Refining Company, etc. Nominal capital, £6,000 in £1 shares. Directors: Mrs. Minnie Bradley, Edward J. Bradley and Peter H. K. Weeks.

Scrap Metal Prices

Merchants' average buying prices delivered, per ton, 18/3/58.

	£
Aluminium	
New Cuttings	160
Old Rolled	130
Segregated Turnings	100
Brass	
Cuttings	108
Rod Ends	106
Heavy Yellow	90
Light	85
Rolled	100
Collected Scrap	87
Turnings	101
Copper	
Wire	145
Firebox, cut up	144
Heavy	138
Light	133
Cuttings	144
Turnings	130
Braziery	114
Gunmetal	
Gear Wheels	145
Admiralty	145
Commercial	121
Turnings	116
Lead	
Scrap	65/10
Nickel	
Cuttings	—
Anodes	525
Phosphor Bronze	
Scrap	121
Turnings	116
Zinc	
Remelted	—
Cuttings	40
Old Zinc	28

The latest available scrap prices quoted on foreign markets are as follow. (The figures in brackets give the English equivalents in £1 per ton):—

West Germany (D-marks per 100 kilos):		
Used copper wire	(£148.0.0)	170
Heavy copper	(£148.0.0)	170
Light copper	(£126.2.6)	145
Heavy brass	(£100.0.0)	115
Light brass	(£69.12.6)	80
Soft lead scrap	(£61.0.0)	70
Zinc scrap	(£39.2.6)	45
Used aluminium unsorted	(£87.0.0)	100
France (francs per kilo):		
Copper	(£187.0.0)	215
Heavy copper	(£187.0.0)	215
Light brass	(£134.17.6)	155
Zinc castings	(£64.7.6)	74
Tin	(£565.10.0)	650
Aluminium pans (98½ per cent)	(£130.10.0)	150

Italy (lire per kilo):		
Aluminium soft sheet clippings (new)	(£194.7.6)	335
Aluminium copper alloy	(£104.10.0)	180
Lead, soft, first quality	(£87.0.0)	150
Lead, battery plates	(£52.5.0)	90
Copper, first grade	(£159.10.0)	275
Copper, second grade	(£148.0.0)	255
Bronze, first quality machinery	(£162.10.0)	280
Bronze, commercial gunmetal	(£133.10.0)	230
Brass, heavy	(£110.5.0)	190
Brass, light	(£98.12.6)	170
Brass, bar turnings	(£113.2.6)	195
New zinc sheet clippings	(£55.2.6)	95
Old zinc	(£40.12.6)	70

THE STOCK EXCHANGE

The Market Turned Dull With Moderate Recessions Fairly General

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 18 MARCH	+RISE —FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1958 HIGH	1958 LOW	1957 HIGH	1957 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	18/–		10	10	11 2 3	19/9	17/9	28/3	18/–
400,000	2/–	Anti-Attrition Metal	1/6		8½	7½	11 6 9	1/6	1/3	2/6	1/6
33,639,483	Stk. (£1)	Associated Electrical Industries ...	49/6xd	—6d.	15	15	6 1 3	50/9	47/–	72/3	47/9
1,590,000	1	Birfield Industries	50/6		15	20N	5 18 9	53/9	50/–	70/–	48/9
3,196,667	1	Birmid Industries	56/3		17½	17½	6 4 3	57/9	56/3	80/6	55/9
5,630,344	Stk. (£1)	Birmingham Small Arms	23/9	—3d.	10	8	8 8 6	26/7½	23/9	33/–	21/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/3	+7½d.	5	5	6 11 3	15/3	14/7½	16/–	15/–
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/10½		6	6	7 2 3	17/–	16/6	19/–	16/6
500,000	1	Bolton (Thos.) & Sons	26/10½		12½	12½	9 6 0	28/9	26/10½	30/3	28/9
300,000	1	Ditto Pref. 5%	15/6xd	+6d.	5	5	6 9 0		—	16/9	14/3
160,000	1	Booth (James) & Co. Cum. Pref. 7%	19/3	+3d.	7	7	7 5 6	19/3	19/–	22/3	18/9
9,000,000	Stk. (£1)	British Aluminium Co.	45/6		12	12	5 5 5	45/6	41/3	72/–	38/3
1,500,000	Stk. (£1)	Ditto Pref. 6%	18/9	—3d.	6	6	6 8 0	19/3	18/4½	21/6	18/–
15,000,000	Stk. (£1)	British Insulated Callender's Cables	40/–	+6d.	12½	12½	6 5 0	42/–	38/10½	55/–	40/–
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord ...	33/–	+1/–	10	10	6 1 3	33/–	29/–	39/–	29/6
600,000	Stk. (5/–)	Canning (W.) & Co.	20/ 0½	+1½d.	25	25	5 19 9	20/10½	20/1½	24/6	19/3
60,484	1/–	Carr (Chas.)	2/3	+1½d.	25	25	X7 15 6	2/3	2/–	3/6	2/1½
150,000	2/–	Case (Alfred) & Co. Ltd.	4/4½		25	25	11 8 6	4/9	4/4½	4/6	4/–
555,000	1	Clifford (Chas.) Ltd.	16/4½		10	10	12 4 3	16/6	16/–	20/6	15/9
45,000	1	Ditto Cum. Pref. 6%	15/10½		6	6	7 11 3		—	17/6	16/–
250,000	2/–	Coley Metals	3/3	—3d.	25	25	15 7 9	4/6	3/3	5/7½	3/9
8,730,596	1	Cons. Zinc Corp.†	47/–		22½	22½	9 11 6	51/6	43/–	92/6	49/–
1,136,233	1	Davy & United	46/3		15	12½	6 6 3	48/–	46/3	60/6	42/6
2,750,000	5/–	Delta Metal	19/7½	—3d.	•17½	•17½	4 9 3	21/4½	19/7½	28/6	19/–
4,160,000	Stk. (£1)	Enfield Rolling Mills Ltd.	26/–		15B	22½	9 12 3	26/6	24/–	38/6	25/–
500,000	1	Evered & Co.	39/–xd		15	15	7 13 9	41/3	39/–	52/9	42/–
18,000,000	Stk. (£1)	General Electric Co.	29/6	—1/–	12½	14	Y7 16 0	38/7½	29/6	59/–	38/–
1,250,000	Stk. (10/–)	General Refractories Ltd.	32/–		20	17½	6 5 0	32/–	27/3	37/–	26/9
401,240	1	Gibbons (Dudley) Ltd.	65/6		15	12	4 11 9	66/3	64/–	71/–	53/–
750,000	5/–	Glacier Metal Co. Ltd.	5/9		11½	11½	10 0 0	6/–	5/7½	8/1½	5/10½
1,750,000	5/–	Glynwed Tubes	13/4½		20	20	7 9 6	13/6	12/10½	18/–	12/6
5,421,049	10/–	Goodlass Wall & Lead Industries ...	19/3xcap	+6d.	18Z	16	6 4 9	19/10½	19/3	37/3	28/9
342,195	1	Greenwood & Batley	46/10½		17½	17½	7 9 3		—	50/–	46/–
396,000	5/–	Harrison (B'ham) Ord.	12/4½		•15	•30‡	6 1 3	12/4½	11/6	16/9	12/4½
150,000	1	Ditto Cum. Pref. 7%	18/9		7	7	7 9 3		—	22/3	18/7½
1,075,167	5/–	Heenan Group	7/3		10	20‡	6 18 0	7/7½	6/9	10/4½	6/9
142,045,750	Stk. (£1)	Imperial Chemical Industries ...	38/6	—6d.	10	10	5 4 0	39/10½	36/6	46/6	36/3
33,708,769	Stk. (£1)	Ditto Cum. Pref. 5%	16/–	—3d.	5	5	6 5 0	17/1½	16/–	18/6	15/6
14,584,025	••	International Nickel	143	—1½	$3.75	$3.75	4 14 0	144½	135½	222	130
430,000	5/–	Jenks (E. P.), Ltd.	7/6xcap	—1½d.	27½ ϕ	27½	9 3 3	7/9¾	7/3	18/10½	15/1½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	15/–xd		5	5	6 13 3		—	17/–	14/6
3,987,435	1	Ditto Ord.	39/6	—3d.	10	9	5 1 3	41/3	37/6	58/9	40/–
600,000	10/–	Keith, Blackman	16/3		15	15	9 4 6	16/3	15/–	21/9	15/–
160,000	4/–	London Aluminium	3/6	—1½d.	10	5	11 8 6	4/3	3/6	6/9	3/6
2,400,000	1	London Elec. Wire & Smith's Ord....	41/–	+1/3	12½	12½	6 2 0	41/9	39/9	54/6	41/–
400,000	1	Ditto Pref.	22/9		7½	7½	6 11 9		—	25/3	21/9
765,012	1	McKechnie Brothers Ord.	35/–		15	15	8 11 6		—	48/9	37/6
1,530,024	1	Ditto A Ord.	32/6		15	15	9 4 6		—	47/6	36/–
1,108,268	5/–	Manganese Bronze & Brass	9/9	+9d.	27½‡	25	7 1 0	9/9	9/–	21/10½	7/6
50,628	6/–	Ditto (7½% N.C. Pref.)	5/9		7½	7½	7 16 6		—	6/6	5/–
13,098,855	Stk. (£1)	Metal Box	44/9	+9d.	20‡	15M	4 9 6	44/9	41/9	59/–	40/3
415,760	Stk. (2/–)	Metal Traders	6/3		50	50	16 0 0	6/6	6/3	8/–	6/3
160,000	1	Mint (The) Birmingham	22/–		10	10	9 1 9	22/9	22/–	25/–	21/6
80,000	5	Ditto Pref. 6%	83/6		6	6	7 3 9		—	90/6	83/6
3,064,930	Stk. (£1)	Morgan Crucible A	39/–	+2/–	10	11	5 2 6	39/–	34/–	54/–	35/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	17/–xd	+3d.	5½	5½	6 9 6	17/3	17/–	19/3	16/–
2,200,000	Stk. (£1)	Murex	53/9	—6d.	20	20	7 8 9	57/6	53/9	79/9	57/–
468,000	5/–	Ratcliffs (Great Bridge)	7/1½		10	10	7 0 3	7/1½	6/10½	8/–	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	27/–		27½D	27½	6 15 9	27/–	26/–	41/–	24/9
1,365,000	Stk. (5/–)	Serck Radiators	11/–		17½Z	15	5 6 0	12/–	11/–	18/10½	11/6
600,400	Stk. (£1)	Stone (J.) & Co. (Holdings)	43/9		16	16	7 6 6		—	57/6	43/9
600,000	1	Ditto Cum. Pref. 6½%	20/–		6½	6½	6 10 0		—	21/9	18/9
14,494,862	Stk. (£1)	Tube Investments Ord.	52/–	+3d.	15	15	5 15 6	53/9	48/4½	70/9	50/6
41,000,000	Stk. (£1)	Vickers	30/–		10	10	6 13 3	31/–	29/4½	46/–	29/–
750,000	Stk. (£1)	Ditto Pref. 5%	15/3xd		5	5	6 11 3	15/6	14/9	18/–	14/–
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	22/–xd		•5	•5	6 19 9A	23/–	21/3	24/9	20/7½
2,200,000	1	Ward (Thos. W.), Ord.	73/9	+3d.	20	15	5 8 6	73/9	70/9	83/–	64/–
2,666,034	Stk. (£1)	Westinghouse Brake	35/6	—3d.	10	18P	5 12 9	36/3	32/6	85/–	29/1½
225,000	2/–	Wolverhampton Die-Casting ...	7/6		25	40	6 13 3	7/9	7/2½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	15/4½	+4½d.	27½	27½	8 19 0	15/6	14/9	22/3	14/9
78,465	2/6	Wright, Bindley & Gell	3/3		20	17½E	15 7 9	3/9½	3/3	3/9	2/7½
124,140	1	Ditto Cum. Pref. 6%	11/6		6	6	10 8 9		—	12/6	11/3
150,000	1/–	Zinc Alloy Rust Proof	2/10½		40D	33⅓	9 5 6	3/1½	2/7½	5/–	2/9

•Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. ••Shares of no Par Value. ‡ and 100% Capitalized issue. • The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. H and 200% capitalized issue. M and 10% capitalized issue. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months. P and 100% capitalized issue, also "rights" issue of 2 new shares at 35/– per share or £3 stock held. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. ϕ And 100% capitalized issue. X Calculated on 17½%.